The Microsoft Innovative Schools Program

Year 2 Evaluation Report

March 2010

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Developed by SRI International for
Microsoft Worldwide Public Sector

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Acknowledgments

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SRI also thanks the following leaders at Microsoft for their support of this research:

- Kati Tuurala and Kristen Weatherby, Directors, Innovative Schools Program
- Lauren Woodman, Senior Director, Government and Education Engagement
- James Bernard, Director, Worldwide Partners in Learning

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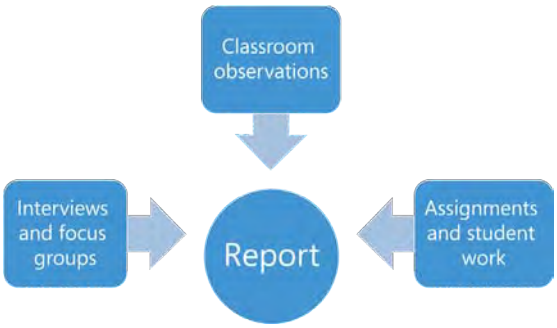
Introduction

For 2 years beginning in 2007, the 12 schools participating in the pilot phase of the Microsoft Innovative Schools Program have been working to transform teaching and learning around the globe. While the reform programs in these schools vary according to local needs and stakeholder priorities, they all share a vision of transforming educational opportunities to include more student-centered learning and to better prepare students for the 21st century. This report, the third in a series on the evaluation of the Innovative Schools Program, tells the story of their journeys during this 2-year period.

The 11 schools[1] described in this report span four continents: Europe (Finland, France, Germany, Ireland, Sweden, and the United Kingdom), Asia (Hong Kong), and North and South America (Brazil, Canada, Chile, and Mexico). Each was selected based on either its exemplary progress to date or its vision and expected capacity to become a leading force for educational reform in its region. The schools operate within varied national education contexts and entered the Innovative Schools Program in various stages of the reform process; together they provide a rich and diverse set of examples of school reform.

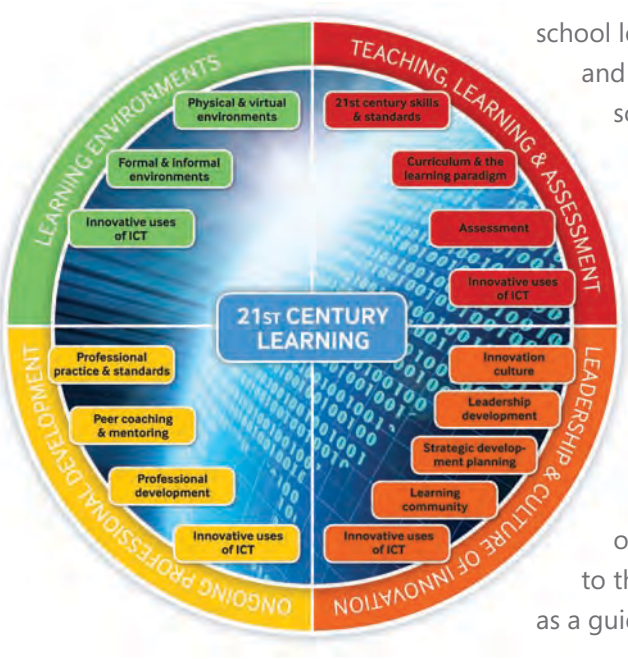
The Innovative Schools Program was designed to foster a global learning community of like-minded reform leaders and to develop and propagate examples of new models of innovative education, with the ultimate goal of preparing students for a changing and connected world. In support of these goals, the program provided tools and frameworks, global conferences, virtual education sessions, and human resources (from local Microsoft partners and leading educational experts) to support the schools on their unique paths to reform.



This report describes results from the 2-year evaluation of the pilot Innovative Schools Program.[2] The evaluation was conducted by a global team of independent researchers coordinated by SRI International. The research leverages data from multiple sources, including interviews with teachers,

1 One school in the Innovative Schools Program, located in Qatar, did not participate in this evaluation.

2 Previous reports from this evaluation can be found at http://www.microsoft.com/education/pil/ISc_home.aspx



school leaders, and other stakeholders; focus groups with students; and observations of lessons. In addition, a set of teachers in each school submitted samples of the assignments they had given students and the work that students did in response. These artifacts of classroom practice were coded according to a common set of rubrics to provide data on the 21st century learning opportunities that students were exposed to in their classes and the 21st century skills they exhibited in their work.

This report draws themes across the variety of paths to reform taken by the schools and proposes lessons learned for other educators who seek to transform learning opportunities for their students. It is organized according to the Innovation Framework that Microsoft provided to serve as a guide for schools as they navigated the many components

Summary of Key Findings from the Global Innovative Schools Program Evaluation

- Overall, technology use among students in the pilot Innovative Schools increased significantly from Year 1 to Year 2 of the program.
- In observed classes, students' high-level technology use—for purposes such as data analysis and multimedia product creation as opposed to more rote uses such as practicing basic skills or word processing—also increased significantly from Year 1 to Year 2.
- Overall in this research, students' work exhibited stronger 21st century skills in response to teacher assignments that called for those skills.
- In several schools, samples of student work that included student use of technology scored significantly higher on several 21st century skills—including Knowledge Construction, Skilled Communication, and Problem-Solving and Innovation—than student work that did not include technology use.
- In some schools in the program, visions for reform progressed from an initial emphasis on technology to a focus on learning and how technology can support it.
- Overall pedagogical changes from Year 1 to Year 2 of the program were mixed, with some schools making progress and others staying the same or losing ground in these early years of reform.
- This research demonstrates both the challenges of reform within a traditional educational system and the fact that progress within these environments is possible. It also demonstrates the need to put supportive cultures and infrastructures in place within schools before widespread instructional changes can be expected.
- The most valuable part of the Innovative Schools Program for the school leaders who participated was the opportunity to take part in a community of peers and experts from around the world who were all focused on creating more innovative learning opportunities for students.

of reform. The report first describes whole-school aspects of reform (including the Leadership & Culture of Innovation, Ongoing Professional Development, and Learning Environments components of the framework). It then describes teaching and learning in the pilot schools, examining both the current state of teaching and learning and changes between the first and second years of the Innovative Schools Program. The report also includes a set of case studies to highlight noteworthy practices in five individual schools.

Context and School-Level Supports for Reform

The progress and path of each school are shaped strongly by its national and regional educational context. Some of the schools in this study benefitted from supportive national initiatives or the autonomy to innovate; others were working within more restrictive environments that offered little flexibility for reform and accountability systems that were based on traditional subject matter learning. Even within these contexts, most of the schools in the study found ways to begin to change their practices, with a scope and pace of reform shaped by the opportunities and constraints of their environment. This research demonstrates both the challenges of reform within a traditional educational system and the fact that progress within these environments is possible.

Within this larger educational context, changes to teaching and learning take place within a school-level context that must include cultures, practices, and supports for innovation to thrive. This research revealed that

- Some pilot schools entered the Innovative Schools Program with a broad vision for the reform they hoped to accomplish but not yet a clear picture of how that reform would take place. In the 2 years of this pilot program, many made progress in two important areas: developing specific plans for reform and moving from a focus on technology to a focus on learning and how technology can support it. Both developments are important precursors to change in the classroom, and both took time to emerge.

- Many pilot schools made progress in fostering collaborative cultures among teachers. The strongest professional learning communities were organized around concrete collaborative tasks and included reflection on the practice and outcomes of innovative teaching and learning.

- In the first year of the Innovative Schools Program, professional development at many of the pilot schools addressed how to use technology. In the second year, some professional development programs made important progress toward a focus on pedagogy, including ways to use technology to enable new opportunities for teaching and learning.

- Successful professional development programs were ongoing and job embedded rather than one-time workshops, and they included opportunities for teachers to apply new ideas in the classroom and reflect on the results to foster continuous improvement of practices.

- Many schools made progress in the addition of infrastructure, including new technologies or new physical spaces for learning. In some cases, these physical improvements were a catalyst for new ideas about what was possible in the classroom.

- For the school leaders who participated in the Innovative Schools Program, the most valuable aspect of their involvement was the opportunity to take part in a community of peers and experts from around the world who were all focused on creating more innovative learning opportunities for students.

Teaching, Learning, and Assessment in the Pilot Schools

In this evaluation, two primary measures of classroom practice were used. Researchers were asked to observe 8 lessons in each pilot school according to a structured protocol that allowed analysts to examine the prevalence of an assortment of teaching practices. In all, 72 lessons led by 69 teachers were observed in Year 2.[3] The second measure was based on samples of actual classroom assignments given by teachers and samples of the student work completed in response to the assignments. These samples were scored according to common rubrics that focused on opportunities to develop 21st century skills. In Year 2, researchers analyzed 250 samples of assignments and 835 samples of student work. In both years, data were collected between March and May.[4]

Highlights of findings are as follows:

- Overall, technology use among students in the pilot Innovative Schools increased significantly from Year 1 to Year 2 of the program. In Year 1 technology use was observed in 49% of observed classes; in Year 2 it was used in 58% of observed classes. Interviews with teachers and students indicated that technology use is becoming commonplace in some schools.

- Although technology use is an essential first step, how technology is used to support learning also matters. This research defines higher level uses of technology as activities such as data analysis and multimedia product creation, as opposed to more rote uses such as practicing basic skills or word processing. Across classes, higher level technology uses were associated with a broader range of innovative teaching practices, suggesting progress toward an overall classroom learning environment that offers innovative learning opportunities.

- In observed classes, students' high-level technology use increased significantly from Year 1 to Year 2. Students used technology for at least some high-level purposes in 47% of observed classes in Year 2, up from 31% in Year 1. The most common teacher and student uses of technology, however, remained fairly traditional.

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3 Actual sample sizes differed from requested totals because varying local circumstances in some schools necessitated customization of the sampling plan.

4 For most schools, this time frame is near the end of the school year, so when Year 1 data were collected many of the schools had already begun to implement their reforms to some degree. For example, some schools reported having introduced technology in some ways or establishing a class to experiment with new pedagogies. Any progress during Year 1 of the program is not reflected in these results.

- In several schools, samples of student work showed that student use of technology was associated with increased evidence of several 21st century skills on the part of students, including Knowledge Construction, Skilled Communication, and Problem-Solving and Innovation.
- On average across schools, assignments that called on students to use technology were significantly more likely to call for collaboration as well, and in some schools technology use as called for in assignments was also significantly associated with higher scores on other
- In schools where professional development programs strongly supported discussion and reflection on effective classroom uses of technology, researchers tended to observe more innovative applications of technology in teaching and learning.
- Overall in this research, students' work exhibited stronger 21st century skills in response to teacher assignments that called for those skills. This corresponds to findings in other research that confirm the critical importance of the quality and expectations of the assignments that teachers give to students.
- Overall pedagogical changes from Year 1 to Year 2 of the program were mixed, with some schools making progress and others staying the same or losing ground in these early years of reform. Data on teacher assignments and student work indicate that after 2 years, opportunities for students to build 21st century skills exist but are not typically deep or widespread; data from classroom observations are consistent with this finding. This research demonstrates the importance of taking the time to establish a firm foundation of school culture and infrastructure before pedagogical changes can be expected to appear in most teachers' classrooms.

Summary and Recommendations

In the 2 years of the pilot Innovative Schools Program, schools have had the opportunity to initiate or deepen their reform programs aimed at innovative teaching and learning supported by new technology tools. In the course of whole-school change, 2 years is a very short time, and most of the schools are still early in their implementation of innovative instruction. However, their experiences and the progress some have made in creating schoolwide cultures of innovation provide a number of recommendations for schools planning to undertake similar reforms and for programs seeking to support schools in their mission.

Recommendations for School-Based Reforms

- Stay focused on teaching and learning. In many environments the use of technology is in itself exciting and innovative and may be a primary driver of reform. However, if the ultimate goal is to provide students a well-rounded set of opportunities for innovative learning, keeping teaching and learning at the forefront is essential. The most successful schools in this pilot program had clear visions for outcomes for learners and school cultures and professional supports were aligned with reaching this vision.

- Take the time to get the foundation right. Some of the schools that began to introduce technology without a clear plan and supportive culture found it necessary to give these important elements more attention in the second year of reform. A strong organizational culture and supportive infrastructure are essential foundations for the journey of innovation.

- Find explicit ways to catalyze change. Comprehensive changes to teaching and learning can be daunting, and some teachers will volunteer to take them on more readily than others. Among the pilot schools, new capacities such as a physical space designed to be flexible and new activities such as an explicit curriculum development project served as catalysts for change and encouraged innovative thinking among teachers.

- Help teachers experience early successes or witness the early successes of their peers. In most schools, new teaching practices began as smaller experiments and took hold on a broader scale once teachers began to see their power, as one teacher put it, "on the faces of the children." Establishing early opportunities to put new ideas into practice can be the basis for professional learning community discussions about what works and how practices can be improved.

- Leverage opportunities for innovation within a traditional system. Some of the pilot schools had the benefit of flexible education systems with policies that support innovation, but others operated within much more restrictive educational environments. Such schools had to be creative in finding opportunities for innovation: by focusing on a part of the instructional program that had more flexibility than others or adding a new course that would not be subject to the same restrictions. In most cases, while traditional educational systems were a persistent challenge to innovation, educators still found ways to make a difference.

Recommendations for Reform Programs

- Recognize that change takes time. As this report and prior research have stressed repeatedly, 2 years is a very short time for making comprehensive changes to teaching and learning. Funders and stakeholders often hope to see progress quickly, and many reforms have been judged unsuccessful when test scores have remained unchanged after just a short time. The experience of these pilot schools suggests that reform is a process, and substantial progress must be made on school-level cultures and supports for reform before widespread change can be expected in the classroom. Reform program supports must be sustained until school-based innovations are stable enough to have a life of their own.

- Offer early supports for translating ideas into practice. During the period of this pilot program, many of the schools struggled to move from a broad vision to a practical focus for school-based reform and to come to consensus on what big ideas like "project-based learning" and "technology-supported teaching and learning" should look like in practice. Practical tools, like the rubrics for analyzing

assignments and student work described in this report and well-documented examples of successful practices can help to make such ideas concrete enough to test in the classroom and can help build a common vocabulary among teachers who are discussing reform.

- Foster cross-school communities of practice that have the same characteristics as effective within-school communities of practice. This report suggests that teachers in school-based learning communities need a specific and practical focus for their collaboration and time to reflect together on progress. In the same way, such features as opportunities for joint classroom projects or collaborative research activities can add power to communities of schools that come together to make a difference.

Overall, schools in this program have demonstrated a variety of different paths to reform, with a variety of starting points and constraints. This report documents a number of important steps that these schools took and offers examples of strong practices that can inspire other reformers about to embark on this journey. In addition, some of these schools have made a commitment to continuous improvement that may keep them on a path toward the ultimate goal of powerful changes to teaching and learning. For these schools, and for the global Innovative Schools Program, 2 years is just the beginning.

1. Introduction

Increasingly, government and education leaders around the world are recognizing the need for a new kind of learning that will prepare their students for success in the 21st century (Commission of the European Communities, 2008; OECD, 2000). Although the vision for this kind of learning varies from place to place, it commonly emphasizes the development of such skills as problem-solving, teamwork, self-direction, and the use of ICT (information and communication technologies) as tools for learning. These skills are seen as essential for working environments that demand new ways of working with information and new ways of collaborating with colleagues either locally or across the world (ISTE, 2000; Partnerships for 21st Century Skills, 2008; Sawyer, 2006). In turn, learning environments that promote these skills for students rely on teachers learning to work in new ways and on a system of supports that promote innovative ideas and processes throughout the school, both among adults and in the classroom (UNESCO, 2008).

Since 2007, Microsoft's Innovative Schools Program has sought to promote a worldwide community of schools that are taking on the challenge of change. In its first 2 years, the Innovative Schools Program worked with a set of 12 pilot schools, each in a different country, each with a goal to transform the learning opportunities it offers students. The schools operate within vastly different educational contexts and have chosen different paths to reform, making the program a rich testing ground and source of learning about educational change in different parts of the world.

This report is a product of the 2-year evaluation of the pilot phase of the Innovative Schools Program.[5] Through the early experiences of these diverse schools, this report describes a set of key success factors for educational innovation: necessary conditions that can work together to support positive transformation of teaching and learning.

This report summarizes 2 years of progress for 11 of the pilot schools.[6] Research on educational innovation consistently points to the need for longer time frames

In Hong Kong, 8-year-old students are figuring out together how to tell whether two lines are parallel. The teacher poses problems of increasing complexity on the electronic whiteboard, and students use the whiteboard's tools to measure or drag the lines to make their solutions visible to their classmates.

In Mexico, students are creating videos to present the results of their research on how teenagers are portrayed in the media and how this shapes their lives. Students work in teams using advanced technologies, generating new knowledge about both an issue important to their lives and the use of new tools for learning.

In the UK, 14-year-old students are designing and testing rockets during their Discovery Time period, seeking to build the one that can stay in the air the longest. In this 2-week project, they will work on developing skills that range from trigonometry to reflective learning.

5 Previous reports from this evaluation can be found at http://www.microsoft.com/education/pil/ISc_home.aspx

6 The twelfth pilot Innovative School, in Qatar, did not participate in the evaluation.

before deep change is demonstrated in the classroom (Adelman, Walking-Eagle, & Hargreaves, 1997; Gandara, 2000). The results presented in this report are consistent with this expectation: After 2 years, most schools have made some changes but have yet to see a consistent transformation of teaching and learning throughout the school. As a set, however, they demonstrate important practices and lessons learned on the path to whole-school reform.

1.1 About the Innovative Schools Program

The ultimate goal of Microsoft's Innovative Schools Program is to give students the skills they need to be successful contributors in tomorrow's workforce and in the rapidly changing, connected world in which they live. In support of this goal, the program focuses on the transformation of educational environments and support of their leaders. By fostering a global community of like-minded school leaders, the program seeks to offer an environment in which school teams can learn together and support each other in their common quest to improve teaching and learning. Program events and supports are organized around a process of holistic school reform in order to promote school-wide cultures of innovation and more student-centered approaches in the classroom.

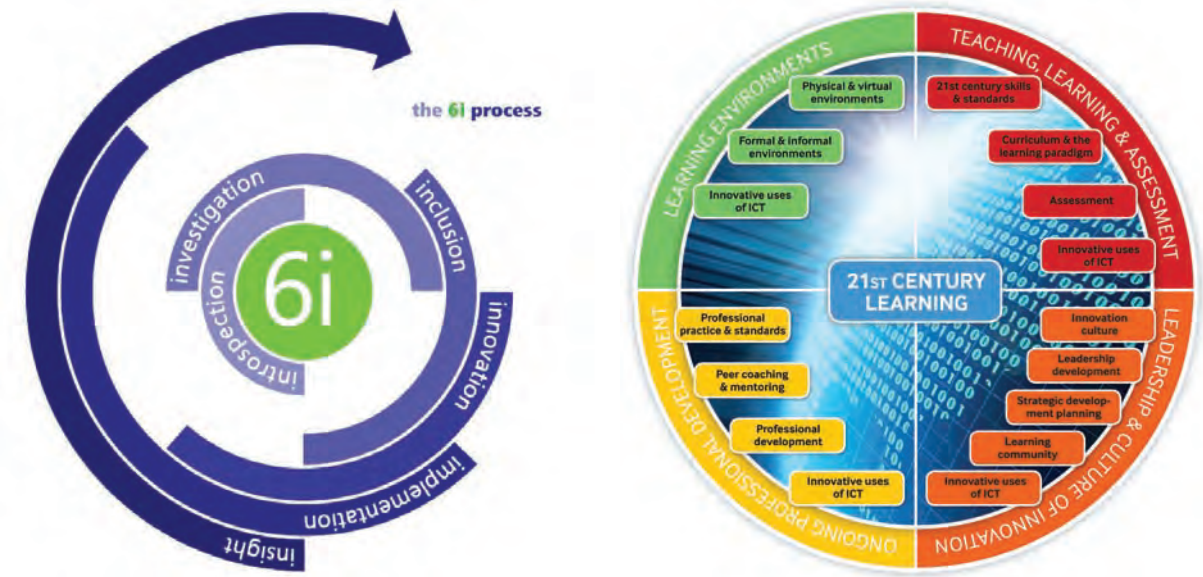
Program leaders recognize, however, that both the path and the ultimate result of school reform must have a uniquely local character in each specific country and school. For this reason, their approach to supporting schools is to guide them in creating their own unique road map based on local needs as well as on common research-informed principles.

The Innovative Schools Program began with a set of pilot schools that participated in a global support network between 2007 and 2009. As part of this program, the schools had the opportunity to:

- Attend twice-yearly in-person meetings at which they accessed outside expertise and discussed reform both within and across country teams
- Participate in Virtual Universities, a series of technology-supported teleconferences at which they discussed their process and challenges with one another and discussed key challenges and strategies with educational experts from around the globe
- Receive counseling from an assigned mentor from the Innovative Schools Program's advisory group[7]
- Work with a local Microsoft Academic Program Manager who could facilitate additional supports such as school visits or access to technical expertise.

7 During the pilot phase of the Innovative Schools Program, advisory board members were Bruce Dixon, Anytime Anywhere Learning Foundation; Chris Gerry, New Line Learning Academies; Sam Houston, North Carolina Science, Mathematics, and Technology Education Center; Anne-Marie Bardi, Ministry of Education, France (retired); Ernesto Laval, TIDE; Erik Huesca, Consultant; Tommy Lopez, Asian Institute of Management; Philip Wong, National Institute of Education, Nanyang University; Robert Hawkins, World Bank Institute; and Ellen Savitz, School District of Philadelphia (retired).

Figure 1. The 6i Process and the Innovation Framework



The program also provided a set of frameworks and tools, offered through Virtual Universities or the program's website, to guide schools through the process of reform. Two of these tools are shown in Figure 1. The 6i process is a model that lays out the important steps on the path to reform and was used to shape the program's offerings, which were designed to offer supports at each step in the process. The Innovation Framework, based on the work of Knapp, Copeland, and Talbert (2003), suggests a set of key factors that must work together for successful whole-school reform: For example, a culture of innovation at the school is an essential foundation so that teachers can have the freedom and support to implement changes to teaching and learning.[8] As described later in this Introduction, the Innovation Framework provides the basis for the organization of this report.

8 White papers describing these tools and their components can be found at http://www.microsoft.com/ education/pil/ ISc_home.aspx.

1.2 About the Pilot Schools

The 12 schools participating in the Innovative Schools Program pilot[9] share the goal of improving students' education for the 21st century. Microsoft selected these schools from a broader set of applicants in these and other countries based on their commitment to educational transformation and their collective representation of a wide variety of reform contexts, approaches, and geographies.

The pilot schools are located in 12 countries in North and South America, Asia, Europe, and the Middle East. The schools are large or small, primary or secondary, rural or urban, and serve students whose backgrounds range from extreme poverty to affluence. Table 1 provides brief descriptions of the reforms in each of the 12 pilot schools. Specific foci of the activities associated with the Innovative Schools Program in the schools include, for example, new student projects supported by technology, teacher professional development programs, or a new software tool to manage and track the development of students' competencies, as well as whole-school efforts to promote new models of teaching and learning.

The pilot schools were in very different stages of reform development when the program began in 2007. Some of the schools already had a strong history of reform: Bowring Community Sports College in the UK, for example, wished to deepen and broaden a program of innovative cross-disciplinary instruction that it had begun implementing several years before. Eight of the schools were earlier in their implementation of reform, either just beginning to envision their planned changes or building on reforms that were still in experimental stages. The set of schools also included one school still under development during the time frame of the pilot program: Ritaharju Yhtenaisperuskoulu in Finland was a new school in the planning stages with a scheduled opening in fall 2010.

In a program this diverse, it is impossible to make blanket claims about progress across all the schools without the risk of misrepresentation. Although this report does describe some overall program results, it does so with caution. The larger goal of this report is to look across this broad spectrum of experience to distill lessons learned about the paths to successful reform.

It is also important to recognize that the Innovative Schools Program was one of a number of influences in the ecosystems that supported and shaped change in each school. As a result, this report describes the progress of the 11 schools during the 2-year period of their involvement in the Innovative Schools Program but does not attempt to draw direct connections between the supports provided by the program and the progress experienced by the schools.

9 In Canada, the Innovative "School" is actually a district-wide professional development program designed to improve literacy instruction among participating teachers.

Table 1. About the Schools

School	Number of Students[10]	Age Range of Students[10]
Instituto Escola Lumiar, São Paulo, Brazil	70	2–15
A fairly new school conceived with a vision of nontraditional teaching, Lumiar uses multidisciplinary, multiage projects in lieu of classes. The school is developing the Digital Mosaic, a software-based learning management system that will allow it to map students' growth in a variety of competencies.		
Literacy@School, York Region District School Board, Ontario, Canada	600	5–18
Literacy@School is a district-wide professional development program in which "learning center teachers"[11] develop strategies for technology-infused, student-centered literacy teaching. Other teachers visit their classrooms, either physically or virtually, and discuss ways to improve their teaching.		
Centro Educacional Erasmo Escala Arriagada, Santiago, Chile	446	9–18
This school is working to integrate technology into teaching and learning. As first steps toward instruction that is more student centered, it has supplemented the regular curriculum with courses such as a projects course.		
Ritaharju Yhtenaisperuskoulu, Oulu, Finland	700	7–16
Still in the design phase, Ritaharju is expected to open its doors to students in 2010. It is envisioned as a "future school," where learning will be integrated with technology and the school will be an active and central part of the community. Currently, reforms are being piloted in other schools in Oulu.		
École Chateaudun, Amiens, France	230	4–11
Chateaudun's reforms focus on technology infrastructure, school organization, and interactions among teachers, students, and parents. Two key innovations involve teachers working collaboratively (including to plan projects for students) and a digital work environment that serves as a repository for teaching and learning materials.		
Gymnasium Ottobrunn, Munich, Germany	1,400	10–18
Ottobrunn is using the "learning plaza" model for learning spaces to introduce more student-centered pedagogies such as project-based learning. The Plaza classes take place in new flexibly designed classrooms and make use of small networked computers.		
Fung Kai Innovative School, Sheung Shui, New Territories, Hong Kong	530	6–12
Fung Kai's reform program, called the "e-school bag," offers students laptop computers with access to digital curricula. Teachers work collaboratively to develop digital curriculum and assessments that take advantage of new technological tools for learning.		
Dunshaughlin Community College, County Meath, Ireland	930	12–18
Dunshaughlin is focusing its reform efforts on the gradual integration of technology into teaching and learning. The school offers professional development and mentoring support to teachers as they experiment with new digital tools and new pedagogies in the classroom.		
Escuela Secundaria Técnica Estatal No. 12, Hermosillo, Sonora, Mexico	673	13–15
Escuela No. 12 focuses on technology integration, project-based learning, and building teacher professional community. For example, students regularly undertake projects, often using technology, and present their findings in exhibitions open to the community.		
Al Bayan Educational Complex for Girls, Doha, Qatar	484	15–17
Al Bayan seeks to promote the development of digitally literate Arab women who are empowered as 21st century learners through the use of innovative pedagogies and ICT. The school encourages teachers to participate in teacher professional communities and conduct their own action research.		
Björknäs School, Nacka, Sweden	1,000	6–16
Björknäs aims to become an anytime, anywhere school through the development of a school web portal. The portal will facilitate communication between teachers, students, parents, and other stakeholders and make school material available for students to access at any time.		
Bowring Community Sports College, Huyton, Knowsley, UK	665	11–16
Bowring is making a major reform to the curriculum to support students' development of "personal, learning, and thinking skills" in addition to content knowledge. Teachers plan lessons collaboratively and learning takes place in flexible spaces to support more active, fluid learning activities.		

10 "Number of Students" and "Age of Students" based on information from http://www.microsoft.com/education/PIL/ISc_members.aspx as of November 6, 2009.

11 Earlier reports referred to these teachers as "demonstration teachers," which is how they were known in earlier phases of the reform.

1.3 About the Evaluation

The evaluation of the Innovative Schools Program followed the reform process at 11 of the pilot Innovative Schools for the 2-year duration of the pilot program (2007–09). The evaluation used a distributed design that was both global and local in scope. The global evaluator, SRI International, was responsible for the evaluation design as well as the coordination and synthesis of results across countries. Research partners in each of the 11 countries carried out the research within the country, adapting common research protocols as needed to be appropriate to the local context. This research design ensured that results were consistent enough to analyze globally yet informed by a strong understanding of each country context.

The national evaluators for the 11 countries were selected through a competitive proposal process and represent leading independent and university-based research organizations. They are shown in Table 2.

Table 2. National Research Partners

UNESCO Brasilia
Institute for Research on Learning Technologies, York University, Canada
Instituto de Informática Educativa, Chile
Center for Research on Teaching, University of Helsinki, Finland
Université de Picardie Jules Verne, France
Institut für Bildung in der Informationsgesellschaft, Germany
Centre for Information Technology in Education, University of Hong Kong
St. Patrick's College of Education, Ireland
Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico
Metamatrix AB, Sweden
Brian Rowe Associates, UK

A range of methods were used in the Innovative Schools pilot research, including both qualitative and quantitative data collection and analysis. Early in the program (October–December 2007), the national research teams interviewed program managers and school leaders to collect baseline descriptive data on the schools and their national and local reform contexts. More extended site visits, including classroom observations, interviews, student focus groups, and collection of teacher assignments and student work samples, were conducted in February–May 2008 and 2009. Evaluators also collected available and locally relevant administrative data, such as achievement test scores and attendance records, as well as any other data needed for locally determined aspects of the evaluation. Data collection methods and timing are summarized in Table 3 and described in more detail in the chapters that present each type of data.

Table 3. Data Collection Methods

	Oct.–Dec. 2007	Feb.–May 2008	Oct.–Dec. 2008	Feb.–May 2009
Interviews	Program manager School leader	Program manager School leader 8 teachers		Program manager School leader 8 teachers
Student focus groups		*3 (6–8 students each)*		*3 (6–8 students each)*
Class/lesson observations		8		8
Collection of teacher assignments and student work	From 6 teachers *(3 assignments, 10 pieces of student work per teacher)*	From 6 teachers *(3 assignments, 10 pieces of student work per teacher)*	From 6 teachers *(3 assignments, 10 pieces of student work per teacher)*	From 6 teachers *(3 assignments, 10 pieces of student work per teacher)*
Achievement test scores	As available	As available	As available	As available

An innovative component of the evaluation was the collection of teacher assignments and student work. A sample of teachers at each operating pilot school supplied samples of the assignments they gave to students and the work that students did in response to those assignments. These artifacts of classroom practice provided a window into the teaching and learning taking place within classrooms. These classroom artifacts were analyzed, in most cases by teachers from other schools in the same country, using a consistent set of criteria for identifying evidence of 21st century teaching and learning. The method is explained further in Chapter 3.

1.4 Report Organization

This report presents information on how the pilot schools have implemented their reforms and their successes and challenges so far. Its organization follows the Innovation Framework (Figure 1) that guides school reform in the Innovative Schools Program, describing first the school-level supports that are essential for effective reform and then the classroom-level transformation that is its ultimate goal. The report is organized as follows:

- National Context and School-level Supports for Reform — Changes to teaching and learning take place within a cultural and regulatory context that influences school change and innovation in the classroom. This chapter uses data from interviews to describe the influence of national and local education contexts. It then describes the progress of the Innovative Schools Program pilot schools' progress with respect to key factors that make up the whole-school environment for innovation: Leadership & Culture of Innovation, Ongoing Professional Development, and Learning Environments from the Innovation Framework (Figure 1).

- Teaching, Learning, and Assessment in the Pilot Schools — Each of the pilot schools is ultimately striving for fundamental transformation of the learning opportunities offered to students. This chapter uses data from classroom observations and from the analysis of samples of teacher assignments and student work to examine the status of teaching and learning in the pilot schools over their first 2 years and describes examples of innovative instruction that are beginning to emerge.
- A Deeper Look at the Innovative Schools — This chapter describes reforms and lessons learned from five of the pilot Innovative Schools, highlighting approaches these schools have taken that might serve as models for other school reformers.
- Summary and Recommendations — This closing chapter offers a summary of findings and recommendations suggested by these results for schools and support programs that are undertaking the challenge of change.

2. National Context and School-level Supports for Reform

This chapter describes important contexts and drivers for classroom-level reform, both within and beyond the school. Reforms of teaching and learning occur within the cultural and organizational context of a school, community, region and country. This chapter begins with a description of the diversity of national and local education systems in the Innovative Schools Program pilot countries and a discussion about how those systems influence reform efforts. The chapter then describes the progress of the pilot Innovative Schools in establishing school-level cultures and capacities that promote change in teaching and learning, focusing on the three school-level elements of Microsoft's Innovation Framework (Microsoft Corporation, 2009): Leadership & Culture of Evaluation, Ongoing Professional Development, and Learning Environments.

National Context and School-level Supports: Summary of Key Findings

- Educational innovation is more challenging in some regulatory environments than in others. Pilot schools have taken either comprehensive or more focused approaches to reform as appropriate to their educational context and readiness.
- Some schools have moved in Year 2 from general goals to more specific plans for reform and from a focus on technology to a focus on learning.
- Distributed leadership and professional communities characterized by concrete collaborative tasks and a strong learning focus can help to promote inspiration and skills for reform.
- The most valuable aspect of the Innovative Schools Program for the school leaders who participated was the opportunity to be part of a community of peers and experts from around the world who were all focused on creating more innovative learning environments for students.
- Strong professional development programs emphasize pedagogical applications rather than solely technology skills and are ongoing programs embedded in teaching practice.
- Most pilot schools have added technology infrastructure, and some have established new physical learning environments; these steps can both support and catalyze change.

Qualitative Data Collection Methods

The data in this chapter come from interviews and focus groups that national evaluators conducted at the pilot schools. Each evaluator interviewed the Microsoft program managers, school leaders, and eight teachers during a site visit to the school. They also conducted three focus groups with students, with approximately six to eight students per group. Visits to the schools took place between February and May 2008 and again in 2009. Evaluators provided SRI with detailed reports from their visits, which were a primary data source for this report. Additionally, SRI conducted case study visits to several pilot schools (case study methodology is described in Chapter 4).

Quotations used in this report come from both the evaluators' reports and from SRI's case study visits. Some quotations have been translated from the speaker's native language.

2.1 The Contexts of Reform

Each country's educational system shapes school reform in fundamental ways. Some of the schools in this program are part of a local or national movement toward educational innovation or benefit from school-based autonomy that lets school leaders and teachers shape educational offerings in ways that they believe support children's learning. Other pilot Innovative Schools operate within very traditional national education systems that leave little flexibility for altering the prescribed curriculum or pace of learning. The progress of each school therefore must be understood within its national context of opportunities and constraints.

Over the 2 years of the pilot Innovative Schools Program, some regional or national educational systems changed relative to support for innovation, but even the direction of change varied from country to country. Table 4 presents examples of specific factors in four of the pilot countries that added either momentum or restrictions for reform.

Many of the pilot schools made it a priority to foster alliances with their regional or local education authorities, and more than half benefited from supportive or symbiotic relationships with their state and local governments. For example, the professional development program in Canada supported by the Innovative Schools Program is integrated with other district-wide literacy initiatives, enabling broader reach and resource-sharing across programs. The Innovative Schools in Ireland and Finland are both part of local reform movements in which a variety of innovative practices are tested in local schools with sharing of results. In Ireland, this local activity provides a supportive context for reform within an otherwise traditional and restrictive educational system. Similarly, the pilot school in Chile has received support from local education authorities, who have been part of the school's decision-making process and regularly attend meetings regarding the school's reform process.

Table 4. National-Level Factors Affecting Reform

Reduced pace of content requirements	**UK**: The UK, which already allows a fair amount of school autonomy, reduced the required pace of content coverage in national middle school standards, opening space for curriculum innovation.	**Increased pace of content requirements**	**Germany:** German schools must work within strict curriculum guidelines. The current national G8 Reform has compressed the duration of secondary schooling by a year, which makes it more difficult to implement reforms that emphasize depth rather than breadth.
Increased emphasis on new pedagogical approaches	**Canada:** New curriculum guidelines from the provincial Ministry of Education emphasize digital literacy, evidence-based teaching strategies, and other reform-compatible approaches.	**Increased emphasis on basic skills**	**Brazil:** Relative to many countries, Brazil's national curriculum standards are flexible and student-centered. However, a new index that rates schools on students' results on a basic skills exam makes test scores more visible and schools more accountable for them.

Nevertheless, in at least four of the pilot schools clashes of reform goals with traditional national assessment requirements remained a significant barrier throughout the 2 years of the Innovative Schools Program pilot. Although there are many elements of national context that can promote or hinder reform, assessments and accountability systems are among the most powerful influences because they shape both the content and the pace of curriculum in ways that often leave little room for deep exploration of important ideas or for the emphasis of skills over factual knowledge (Pedulla et al., 2003). In one school, the school leader has filed for an exemption from particular requirements that strongly inhibit the progress of reform. Some schools where students must prepare for important traditional exams have experienced resistance from members of the educational community, including not only parents but also students who sometimes express concern that pedagogical methods like project-based learning do not prepare them as well for success on the exam.

Within these varied environments, the schools' overall approaches to reform took two primary paths. Some schools had the autonomy to engage in whole-school curricular reform; others worked within the existing system, focusing on embedding new types of learning activities within existing course sequences and schedules or creating initial pockets of innovation rather than altering instruction in most of the school. These paths are described in more detail below. In most cases, schools chose the strategy that they saw as an appropriate starting place given the requirements of their local educational system and the resources they could apply to reform.

Two of the pilot schools have undertaken a comprehensive reform of the school-wide learning environment, including both curriculum and associated course structures

Even schools operating in very traditional education systems with considerable top-down control have been able to provide their students with some experiences of student-centered instruction.

Comprehensive Reform of the Learning Environment

At Bowring Community Sports College in the UK, many classes have been restructured into interdisciplinary blocks such as Challenge Time, Team Time, and Discovery Time, with curricula that focus on student-centered learning and include extensive use of collaborative and project-based learning. Students engage in activities that cut across traditional academic subject areas and provide opportunities for developing "personal, learning, and thinking" skills that can enable them to become effective learners throughout their schooling and outside school. The personal learning and thinking skills serve to unify the curriculum and drive both instruction and assessment.

At Instituto Escola Lumiar, the pilot school in Brazil, the curriculum centers on project work rather than traditional subject-based classes. Students discuss possible project ideas at school-wide meetings called rodas, a structure that provides space for open discussion among the whole school community. Students can then sign up for projects of their choice. Projects are multidisciplinary and conducted with multiage student groups. The school has also been involved in the development of a software tool, the Digital Mosaic, that aims to enable individualized planning and student assessment by tracking students' development in terms of a set of predefined competencies, including those related to reasoning, argumentation, and emotion. Once the tool is completed, the competencies in the Digital Mosaic are intended to organize the curriculum and drive instruction at Escola Lumiar.

in some or all subject areas.[12] The innovative structures of education in the UK and Brazilian schools are described in the sidebar. The educational contexts in both the UK and Brazil offer more school-level autonomy than in most countries. In each case, the schools have undergone a fundamental rethinking of the structure of classes and curriculum as well as the student skills that they seek to develop. Neither of these schools implemented the new learning paradigms solely during the 2 years of the pilot Innovative Schools Program: Both entered the pilot program with models that were already fundamentally different from traditional teaching and learning, and both schools continue to grapple with important tensions such as the balance between 21st century skills and rigorous subject-matter learning within the curriculum.

But even schools operating in very traditional education systems with considerable top-down control have been able to provide their students with some experiences of student-centered instruction. A strategy a number of schools chose was to work to integrate new activities and learning paradigms within existing course structures. The pilot schools in France and Mexico, for example, are working within the existing national curricula but adding project-based work at the classroom level to enrich the national curriculum and provide more in-depth learning for students. The school in Hong Kong is going a step further: While maintaining existing course structures and content guidelines, teachers are working by grade level and subject area to create an entirely new curriculum, complete with lesson plans and digitized instructional materials for use in the classroom. The new digital curriculum is more interactive and participatory than previous curricula.

Another way to inject innovative teaching and learning into a traditional education system is to introduce new courses or new structures to catalyze the implementation of new curricula. For example, the pilot school in Chile has introduced four new courses as a supplement to its existing subject-based curriculum. Those courses—Project Space, Mentoring, Debates, and Artistic Expression—have an interdisciplinary, skills-based orientation that makes them conducive to project-based learning. Teachers report that these courses have been an effective way to introduce new instructional strategies and new types of student learning at the school. Rather than facing the daunting task of uprooting the learning paradigms already in place in existing classes, these new classes gave teachers a focused opportunity to experiment with new practices and provide students with an initial opportunity to learn important 21st century skills.

12 A third school, in Finland, is still in the planning stages but is expected to have innovative school-wide structures built in to the organization when it opens in fall 2010.

2.2 Leadership and Culture of Innovation

Many schools around the world contain pockets of innovation: innovative and talented teachers who are inspired to create a classroom learning environment their students can thrive in. But for improvements to teaching and learning to become widespread, innovation must be actively promoted at the whole-school level (Law, 2008; Microsoft, 2009). This section describes the vision and leadership of reform at the pilot schools and the learning communities that can facilitate innovation and capacity-building among teachers.

Reform Vision and Leadership

Because the context of reform is so different in each school setting, the Innovative Schools Program is intended to provide broad support for school-wide movements toward 21st century teaching and learning, giving each school-based program the freedom—and therefore the responsibility—to define its own specific goals and plan for reform. The pilot schools entered the program with varying levels of experience with reform practices. Some already had a well-defined program of reform in place, so the initial development of a vision was less an issue for them during the time period of this evaluation. Others were starting new programs, and an important and time-intensive initial task was to form a concrete vision and plan.

At the inception of reform, goal statements are often very broad: Schools may want to support the development of specific student competencies, for example, or to encourage a stronger and more positive community spirit within the school. As described in an earlier evaluation report (SRI, 2009), at the end of the first year some of the pilot schools were still lacking stakeholder consensus on a local vision for the Innovative Schools Program reform that was specific enough for everyone to understand and help implement. In some schools that began the Innovative Schools Program with a general vision rather than a specific plan, the first year was functionally a planning year, and real implementation of a coherent program did not begin until Year 2.

In the second year of the program, although teachers in several of the schools still did not have a clear or unified picture of the reform, other schools had made progress in focusing or deepening their specific plans. For example, in one school the Innovative Schools Program reform was initially seen as broadly connected to a number of existing school-wide efforts. By the second year, stakeholders had agreed to develop new classes as a testing ground for a specific model of instruction that focuses on group work, projects, and use of technology.

One specific element of vision that evolved in several of the schools is the role of technology in reform. The goal of technology-supported instruction is a common feature of the Innovative Schools. Consistent with previous research (Hall & Hord, 2000; Sargent, 2003), participants' views of reform in some of the schools shifted over time from seeing the program as primarily about technology to seeing it as primarily about teaching and learning with technology as a key enabler. This

Participants' views of reform in some of the schools shifted over time from seeing the program as primarily about technology to seeing it as primarily about teaching and learning with technology as a key enabler.

was evidenced both in descriptions of program goals by reform leaders, and in statements from teachers about their own shifts in thinking about technology's role in classroom practice. Participants' changing views on the role of technology are exemplified by what they said in interviews:

> *I suppose in the beginning, I would have thought it was really about using computers in the classroom to reinforce what we were doing… but now I can see that there are elements to do with teacher development… that it's not just a matter of using computers in the class… but broadening our understanding of all the tools that are available… and how they can impact on the teacher and on the learning.*
>
> *It was the basic fact: We had to do something with computers… But now it is totally integrated in my practices, that is to say that I do not think about that anymore, [and] neither [do] the students. The computer became a tool like the other [tools available in the classroom], maybe even more than the others because students go more easily to computers than to a notebook or anything else.*
>
> *At the beginning, we just focused on the electronic materials. Now we're shifting our focus to the learning and teaching aspects, and how to motivate students to learn.*

Developing a clear and specific vision for reform is one important task for reform leaders; another is inspiring teachers to participate and commit to new classroom practices. Research has repeatedly demonstrated the relationship between strong leadership and teacher buy-in to reform (Harris, 2002; Lambert, 1998; Sebring, Allensworth, Bryk, Easton, & Luppescu, 2006).

At a minimum, generating commitment requires strong communication of a clearly defined vision. Data from the pilot schools suggest that school leaders who effectively communicate a vision for reform are more likely to generate support from teachers, as described in the sidebar. Strategies adopted by various school leaders include, for example:

- Discussion of program goals at regular staff meetings
- Individual meetings with teachers
- Dissemination of the vision to the broader community through lesson demonstrations or other community events.

An important aspect of strong communication is listening: Teachers in one school reported that the school leader frequently said at weekly meetings, "We are a family, so you have to tell me your problems."

A stronger mechanism for generating buy-in among teachers is distributed leadership, which engages teachers in building and evolving the vision, not just receiving it (Stevens, 2008). In about half the schools, leadership of reform is distributed across teachers to a significant extent, either by giving specific reform leadership roles to particular teachers or by sharing decision-making more broadly.

In one pilot program, participating teachers are "running the show collectively," according to one teacher. School leaders who took this approach claimed that it was essential to promoting ownership and ongoing momentum for reform among teachers. Said one school leader, "They're the critical group who will bring this thing [together] and drive it forward." A teacher noted that members of the reform's "core team" could "use our experience to influence the other people and to guide other teachers to join this project."

Where these mechanisms for generating buy-in were lacking, teachers described confusion and lack of ownership of the reform. According to one teacher, "I haven't really got a handle on the overall, why this is being done or what the whole thing is about, how it hangs together." In this teacher's language, reform is something that is "being done," with the teacher as an outside party. In one school, teachers reported that they began the program with excitement about the promise of reform but have become increasingly frustrated because of a lack of information and an inability to influence the reform.

In contrast, teachers working together can build momentum for change and support each other's development of new capacities to teach in new ways (Fullan, 2006; Sebring et al., 2006). In their first 2 years, most of the pilot schools have worked on building a professional learning community within their walls as a mechanism to empower teachers to take on new models of teaching and learning. Some of these learning communities have also included students, parents, and educators beyond the school.

Learning Communities Within the School and Beyond

Professional Learning Communities for Teachers

Professional learning communities are often cited as a powerful driver of instructional reform (e.g., Fullan, 2008). In professional learning communities, teachers form groups to build new practices together and support each other's learning. Effective learning communities give teachers "an opportunity to learn about, try out and reflect upon new practices in their specific context, sharing their individual knowledge and expertise" (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009, p. 9). The benefits can reach not only teachers but also students: Strong teacher learning communities have been linked to academic achievement gains and reduced dropout rates for students (Newmann & Wehlage, 1997).

Communication and Commitment to Reform in Mexico

At Escuela Secundaria Técnica Estatal No. 12 in Mexico, effective communication and a strong supportive community have helped sustain commitment to reform despite teacher turnover. The school leader makes her educational vision well known to teachers by talking about reform at regular staff meetings and holding individual meetings with all teachers to discuss program goals. New staff members receive a CD-ROM with reform-related documents, the school mission and vision statements, and subject-specific materials. "The school leader has been a really important motivator," said one teacher. New staff members are also quick to acknowledge the support they've received from veteran teachers and say that informal teacher communication has been crucial for helping them adapt to the goals of the reform. "We have a really strong community of teachers here," said a veteran staff member.

Building Momentum for Change in Finland

While other schools in the program are working to build momentum for reform among their existing teachers, the Finnish pilot school, which has not yet opened its doors, has the opportunity to hire teachers who support its vision for 21st century teaching and learning. It has built the teacher recruiting process around this vision, using a competence map the school developed with help from Microsoft. The map currently informs teacher recruiting and will eventually be used to diagnose teacher professional development needs as well.

Strong professional learning communities are organized around joint work and responsibilities.

Characteristics of Strong Learning Communities

Strong professional learning communities
- Are organized around joint work and shared responsibility, such as
  - Shared planning or curriculum development
  - Peer observation and feedback
  - Analysis of student work
- Are supported by school leadership
- Exist in a culture that values risk-taking and innovation
- Empower teachers to make decisions
- Require that teachers have common planning time available.

To achieve these ends, professional learning communities must be more than opportunities for teachers to talk with each other. This section describes the progress of learning communities in the Innovative Schools through the lens of a set of characteristics for strong learning communities that are described in a 2009 review of international studies of teachers' professional learning (Wei et al., 2009, summarized in the sidebar).

Strong professional learning communities are organized around joint work and responsibilities, such as shared planning, collaboration on curriculum, working in grade-level teams, or observing and giving feedback on one another's teaching (Little, 1990). Teachers must "rely on each other to complete a task" (Wei et al., 2009, p. 10), giving them explicit motivation to work together. Roughly half the pilot Innovative Schools have opportunities for teacher collaboration that are structured around a shared task. In these schools, teachers are collaboratively developing plans for student projects or lessons, collaborating as grade-level teams to redesign the curriculum, or team-teaching their classes. These teachers depend on one another and together they accomplish something that is directly useful in their teaching work. In contrast, pilot school teacher communities that lack a strong purpose are generally described as less integral to teachers' practices.

Another way teachers can establish a purpose for their work together is by supporting the improvement of each other's practice, for example, through collaborative analysis of student work or peer observations (Ball & Cohen, 1999; Dunne, Nave, & Lewis, 2000; Hord, 1997; Little, 2003). Communities can also form around common topics of study (Hollins, McIntyre, DeBose, Hollins, & Towner, 2004; Killion, 1999, 2002a, 2002b). In a few of the Innovative Schools, such communities are forming.

- Analysis of student work: Several Innovative Schools took advantage of the process of analyzing 21st century qualities of teacher assignments and student work developed for the Innovative Schools Program evaluation (this evaluation process is described in Chapter 3). Several schools trained their teachers on the detailed rubrics that describe specific "dimensions" of 21st century teaching and learning[13] as a framework for analyzing their own work in the classroom and the work of their peers. Teachers report having benefited both in their own professional development and in developing a common language to discuss teaching and learning with their peers. In one of the schools, teachers worked together to code student work and had high praise for the activity. One teacher said, "It made me think about giving assignments… I really would think, 'Is the student getting the full benefit out of this assignment?' Or is it going to be just… a single thing that they'll get out of it, rather than have them use all of their skills?" Teachers also said the coding activity helped them realize connections and common goals across departments.

13 These dimensions include, for example, knowledge construction; problem-solving and innovation; and collaboration.

- Peer observation: In Canada's Literacy@School program, teacher observations of "learning center teachers" is one of the program's major foci. Literacy@School is based on the idea that teachers can learn from visiting learning center teachers, who have been selected for their strong pedagogical skills and trained in the use of technology and constructivist literacy teaching strategies. Classroom visits are followed by discussions about the practices seen in the observed class, with the goal that teachers will take some of what they have seen back to their own classrooms. Program leaders hope to further develop the peer relationships between learning center and visiting teachers by allowing for longer term interactions between them and more follow-up after visits.

- Common topics of study: At Dunshaughlin Community College in Ireland, a small group of teachers is working together as a study group. The teachers are pursuing a postgraduate program at a local university on digital learning. As part of this program, they conduct school-based research on their own classroom practices. They commented that working together as a group has brought them in contact with new ideas from colleagues with whom they might not otherwise have interacted. One said, "The group that I'm mingling with through [the degree program], I wouldn't normally be associated with... I have found that [group] very helpful... bouncing ideas off each other and hearing what other people are doing."

- Codeveloping curriculum. In at least two of the pilot schools, teachers are codeveloping a new curriculum, which serves not only to change teaching and learning at the school, but also to bring teachers together as a community. Teachers' use of collaborative time for curriculum development in one school is described in the sidebar.

Strong professional learning communities have adequate support from school leadership, exist within a climate that supports risk-taking and innovation, and empower teachers to make decisions (Hord, 1997; Louis, Marks, & Kruse, 1996). At least half the pilot Innovative Schools have supports like these in place. For example, Canada's Literacy@School learning center teachers have control over the topics of discussion on professional development days when they meet face to face. One teacher said that his ability to take a leadership role in this professional learning community had helped him grow: "I could not be the teacher I am without being part of the program."

As a result of efforts to develop stronger learning communities over the 2 years of the Innovative Schools pilot program, teachers and leaders in many of the schools felt that there was an improved working climate and more teacher collaboration. One teacher said, "I used to do everything by myself; now I do it

As a result of efforts to develop stronger learning communities over the 2 years of the Innovative Schools pilot program, teachers and leaders in many of the schools felt that there was an improved working climate and more teacher collaboration.

Teachers' Use of Collaborative Time in Hong Kong

Teachers at Fung Kai Innovative School are codeveloping a new digital curriculum that will be enabled by tools such as students' new netbook computers and electronic whiteboards in every classroom. Workloads are balanced each year to allow the teachers of each grade/subject whose curriculum is being rewritten time to work together for up to 8 scheduled hours per week. Development of the lessons they will use with their students provides a focus for teachers' collaborative time, and the knowledge that they will contribute to students' motivation and success provides the incentive. In their discussions, teachers follow a process that includes brainstorming likely student challenges with the topic, consulting existing resources, selecting activities to build on students' existing knowledge, and designing materials. After each unit, teachers debrief on how it went and note lessons learned for future lessons and future users of these materials.

Although most Innovative Schools have made some progress in developing a teacher learning community, only a few have created a clearly defined role for students within the learning community.

in a more multidisciplinary [way], joining efforts with my colleagues." Another noted that the Microsoft SharePoint site established last year for the sharing of lesson plans was gaining momentum: "There are literally probably 25, 30 items on that now," which teachers can leverage in their own instruction. Teachers also said they felt this increased collaboration was beneficial for their professional learning. According to one teacher, "It feels I am with an elite group of people that I can learn from, and it is a safe environment, as we are not gatekeepers—we are always pushing each other.," Another said, "The discussion among teachers developed my professional knowledge and skills."

Students, Parents, and Others in the Learning Community

With the community of teachers in the school as a core, some schools are expanding their learning communities to include students, parents, or a broader circle of education stakeholders beyond the school.

- Students: Research has shown that having a sense of belonging and empowerment through inclusion in the school learning community can enhance students' motivation, behavior, and self-concept as learners (e.g., Osterman, 2000). At this point in their reform process, although most Innovative Schools have made some progress in developing a teacher learning community, only a few have created a clearly defined role for students within the learning community. At the Innovative School in the UK, student researchers actively influence ongoing school improvement with the results of their research. At the pilot school in Brazil, students are included in the learning community through regular all-school meetings at which they are encouraged to suggest matters for school-wide discussion and topics for future study. Finally, several schools allow students to contribute to the community through their technology skills, helping peers or teachers with technology problems. In some cases this support is informal, and in others it is a purposely cultivated practice.

- Parents: Some Innovative Schools have taken initial steps toward involving parents with their reform work, often reaching out through technology. For example, some schools use technology to give parents access to student work and curriculum or have plans to offer this type of access by posting grades or curricula to a website or a password-protected digital workspace. Additionally, schools include parents in their reform processes by discussing project goals with them or inviting them to see the products of student work; for example, one school holds all-school presentations of students' projects to which all parents are invited.

- Participants beyond the immediate school community: Several of the Innovative Schools have broadened their reform to include learning partnerships with other educators within their local area. Including broader groups of teachers with a shared interest can be an effective way to build a learning community (Darling-Hammond & McLaughlin, 1995; Fullan, 1991). Several schools are engaging in district-wide communities of school leaders and teachers to share practices through mechanisms such as Microsoft SharePoint and face-to-face training and showcases, initiating a program of peer mentoring. Three of the pilot schools are including other schools in their community of practitioners as they try out new instructional practices and share lessons learned in the reform process.

- Global community of reformers: All the Innovative Schools have had the opportunity to interact with and learn from other program participants around the world who share the common goal of providing a 21st century education for students. Program supports for community include global in-person meetings, Virtual Universities (teleconferences with an online component), and an online community space; some schools also had the opportunity to visit mentor schools in other countries. Although online Virtual University activities were deemed worthwhile, participants cited the face-to-face meetings and school visits as the most valuable forums for networking with and learning from other schools. Many interviewees noted that they would have liked to have stronger connections to the other program participants through additional focused tasks such as collaborative curriculum projects.

Challenges in the Creation of Learning Communities

The schools have experienced and have attempted to address several common challenges to creating strong learning communities. First, teachers often have trouble determining the shared purpose of their group and getting all members to participate equally (Little, 2003). Second, schools must offer time for teachers to work together, or "common planning time" (Louis, Marks, & Kruse, 1996).

At many of the Innovative Schools, teachers cite a lack or shortage of common planning time as a challenge and constraint to collaboration. In at least one of the Innovative Schools, teachers who are developing new curricula collaboratively have been given additional time in their schedules to work together. In other schools, teachers are attempting to mitigate the challenge of finding time to collaborate through the use of technologies, discussed in the sidebar.

In several pilot Innovative Schools, evaluators note that some teachers and some departments are more willing to collaborate than others. Nevertheless, collaboration seems to have grown from Year 1 to Year 2. Leaders at these schools believe that teachers cannot be forced to collaborate. They focus on setting up opportunities for collaboration, but allow it to develop from the bottom up rather than dictate collaboration from the top down. Said one school leader, "I don't believe you can force people to share." This teacher-driven approach has been successful at these schools, with a large number of teachers choosing to learn from their colleagues as they experiment with new practices.

Use of Technology for Learning Communities and Professional Development

Some of the Innovative Schools are using technologies such as SharePoint or e-mail to mitigate the challenge of not having enough face-to-face time for collaboration. For example, Canada's Literacy@School learning center teachers, who work in different schools across the district, use SharePoint to post projects and hold discussions on technology and pedagogy. In Sweden, the school's new web portal allows teachers to share digital resources with one another.

Technology can act as a support for professional development. In the Innovative Schools, this has primarily meant computer use during professional development sessions; for example, teachers bring laptops to show each other applications they have been using or technology is used to give presentations. In at least one school teachers can take online courses for professional development, and in another teachers use video of their teaching to prompt discussions about technology use and pedagogy.

2.3 Ongoing Professional Development

In addition to the creation of learning communities for teachers (which are themselves an opportunity for teachers to grow professionally), schools are offering more conventional forms of professional development. The National Staff Development Council report looked at teacher professional development practices around the world (Wei et al., 2009). Some of the findings are summarized in the sidebar.

In the Year 1 evaluation, we reported that many countries offered professional development for basic technology skill development, aimed at teachers who were new to the use of technology. There was less focus in the first year of the program on the introduction of innovative pedagogies such as project-based learning or the integration of technology with curriculum and pedagogy. Teachers noted this lack of pedagogical support as an impediment to improving their teaching practices.

In the second year of the program, there was evidence of a shift in some countries from professional development focused on basic technology skills to professional development emphasizing pedagogy and integration of the technology.

In the second year of the program, there was evidence of a shift in some countries from professional development focused on basic technology skills to professional development emphasizing pedagogy and integration of the technology. Additionally, some countries offer teachers long-term, multidimensional professional development opportunities that allow them to apply what they learn as they go. Although programs that meet the tenets of effective professional development are still an important need for many of the schools, Innovative Schools programs in several of the countries provide strong examples of comprehensive programs that meet the needs of teachers.

These programs concentrate on developing teachers' pedagogical skills with technology, not just their ability to use particular software programs or hardware. They are long-term engagements and intense enough to potentially impact the classroom practice of their participants. They fit with the overall model of reform in their respective contexts, enabling teachers to more easily take what they learn to their classrooms. Two of these programs are described in the sidebar.

Another method that addresses criteria for effective professional development is coaching, usually from expert practitioners who are often current or former teachers. Coaching programs can be designed to be sustained over time and integrated with actual practice, features that experts agree can help promote changes in practice (Wei et al., 2009). In the first year of the Innovative Schools Program, about half the pilot schools were implementing some form of coaching (peer-to-peer teaching, mentoring, or

Effective Professional Development Practices (Wei et al., 2009)

To be effective, professional development should be

- Concrete, focusing on "enhancing teachers' knowledge of how to engage in specific pedagogical skills and how to teach specific kinds of content to learners" (p. 3)
- Sustained over longer periods of time, rather than one-time workshops
- Coherent with other parts of school reform, such as new curricula
- Inclusive of opportunities for practice, so that teachers can test what they learn
- Collaborative, so that teachers can work together on changing practice school-wide.

use of master teachers), usually to support teachers in their use of technology. In the second year of the Innovative Schools Program pilot, the focus of some of these programs evolved from technology how-to's to support for using technology tools to improve teaching practice. For example, former teachers who are now full-time coaches work with teachers at least twice a week at one school to help them prepare materials and plan classes. Another school has a staff person dedicated to leading teacher meetings, team-teaching with teachers, conducting classroom observations, and discussing model lessons with teachers. The pilot school in Sweden is using the Microsoft Peer Coaching program, training teachers to act as coaches for one another. Teachers create lessons that they share with peers for review and further development.

Professional Development at Dunshaughlin Community College

Professional development is the primary vehicle of reform at Dunshaughlin Community College in Ireland. Finding that the state-run program did not offer the types of professional development programs that teachers wanted, the school has partnered with a university to offer in-depth courses that help teachers learn not just technology skills, but also ways to integrate technology with teaching and learning. The courses are designed in response to input from teachers about their professional needs, and pedagogy is as much as focus as technology. As part of the program teachers also have access to technical and professional support personnel to help them implement innovative practices in their classrooms.

In addition to one-time workshops, teachers may also choose to engage in a program of professional development that will lead them to a postgraduate diploma or even a master's degree. In the course of their diploma work, teachers engage in a long-term classroom-based research project, applying what they have learned to their work in the school.

Professional Development through the Literacy@School Program

Literacy@School, a program based in York, Ontario, Canada, regularly brings together a group of "learning center teachers" to act as leaders for use of technology in literacy teaching in the district. The learning center teachers, selected for their strong pedagogical skills, meet regularly to learn about how to infuse their teaching with technology in meaningful ways. The goal is not to use technology for technology's sake but to use it in ways that are pedagogically sound. Said a program leader, "Through these conversations teachers are beginning to understand it is no longer [an electronic whiteboard], it is a tool that plays a significant role in modeled writing."

Last year, professional development sessions for the group of nearly 60 learning center teachers generally included presentations led by the program leaders. This year, the program has transitioned to teacher leadership and more of a discussion-based model. To cover the topic of differentiated instruction, teachers produced short videos of their own teaching and shared them with small groups during a session. Together, they explored what they were doing well and what they still had to learn, selecting four key areas related to differentiated instruction, use of technology, and literacy teaching for further exploration. At a later session, the teachers brought in more examples from their teaching, related to the four key areas, so they could engage in more in-depth discussions.

When focused on specific ways that new technologies and facilities can contribute to changes in teaching and learning, infrastructural changes can be an important driver of reform.

1:1 Laptop Integration in Sweden

At Björknäs School in Sweden, laptops are being distributed to each student as part of an effort to promote 21st century skill development. Students in grades 1, 4, and 7 are already using laptops, and the school hopes to achieve full 1:1 access by fall 2010. As part of its agreement with the municipality, the school will pay for 25% of the cost in the first year, 50% in the second year, and 100% in the third year. The school's ICT program also includes a tablet personal computer for each teacher and a new web portal to promote sharing of digital resources.

Although it is still too early to evaluate the results of the 1:1 program, initial reports from students and teachers are positive. In classrooms, laptop use is helping students and teachers interact and collaborate on the school's web portal. In addition, teachers report being more motivated to create stimulating lessons—a positive step forward for both teachers and their students.

2.4 Learning Environments

While teaching and learning take place primarily in the classroom, school-level elements of the learning environment also serve as important frameworks and supporters of innovative teaching and learning. This section describes the infrastructural supports, both facilities and technology, that facilitate new learning environments where teaching and learning can flourish. Some pilot schools have added new technology, improved the reliability of existing ICT infrastructure, and adapted facilities to meet reform needs. These infrastructure changes have enabled school leaders, teachers, and students to more easily engage in innovative teaching and learning practices. When focused on specific ways that new technologies and facilities can contribute to changes in teaching and learning, infrastructural changes can be an important driver of reform.

ICT Infrastructure

Nearly all the pilot schools added new ICT infrastructure during the past year, typically by leveraging partnerships with local and international technology companies, as well as with government agencies. Across schools, new technological installations included computer labs, laptops, wireless Internet, educational software, interactive whiteboards, and other peripherals, including digital cameras. In one school, efforts to add infrastructure have extended beyond the classroom and into students' homes: A local mobile phone company is working with school leaders to provide wider broadband access to the Internet. As part of the agreement, schools and families share the cost of cellular wireless Internet, enabling remote student access to online school resources and furthering the goal of anytime, anywhere learning.

Nearly all pilot schools have chosen to make laptops more available as part of their ICT expansion. To date, a few schools have provided one computer per student, and several more have started with particular grades and have plans to expand access to all students. Other schools have chosen to use mobile laptop carts, allowing several teachers to share a set of laptops for use in their classrooms. At Bowring Community Sports College, laptops are also made available for checkout, so that students without home ICT access can use school resources and complete their assignments from home. As with other ICT infrastructure, laptop integration in the pilot schools has been most successful when the computers are introduced as part of a broader set of goals and strategies. In one district, explained the school leader, laptops

have not yet been rolled out to all students, but the focus instead has been on the required infrastructure to facilitate the success of the eventual rollout: "We have built up a set of what we call web-based services—educational resources and other services, e-mail and access to records and so on—that now means the students can very usefully use a laptop."

Equally important, several schools have also improved existing infrastructure by addressing the reliability of Internet connections and systemizing access and technical support. By tackling ease-of-use issues, these schools have reduced barriers to ICT integration. As a teacher in one such school commented, "It is very handy and easy for us to use technology in the classroom. We use technology more often in our teaching."

Others using web portals and classroom response systems feel it has been easier to implement nontraditional assessment and differentiated instruction: "With the use of technology, we can quickly get an overall picture of how students are doing and in which areas they need the most help."

Despite these advances, nearly all the pilot schools still face barriers related to the availability and reliability of technology. Many teachers express frustration that computer rooms or laptop carts are often not available and that even when they are, they do not provide enough access to students. In other cases, existing computers hinder progress when they malfunction or connect poorly to the Internet. Moreover, as schools expand the technology infrastructure in their classrooms, they also create additional challenges for teachers, who must learn to use interfaces and procedures that they are not familiar with.

Flexible Learning Environments

In addition to technology infrastructure, some schools have also made progress in reconfiguring their physical learning environments to promote innovative pedagogy and better support technology integration. Some schools have begun to explore modifications such as adding flexible furniture or removing classroom walls. While many schools were constrained in their opportunities for significant physical changes because of regulatory requirements or budgets, four of the schools were able to implement more significant changes such as constructing entire school wings or buildings. Physical changes to classrooms are not only visible reminders of reform, they can also disrupt the status quo by forcing teachers to think about how they use available resources.

Plaza Classes in Germany

The new "Plaza Wing" at the Gymnasium Ottobrunn in Germany is activating curricular and instructional innovation by providing a dedicated space to implement new practices. The Plaza Wing has flexible classrooms, with mobile desks and blackboards, a flexible wall that can open to join classrooms into one larger learning space, and a common space where teachers and students can meet. Although the curriculum is preset by the National Authorities, Plaza teachers have been able to implement large and small projects within their classes. Along with the projects, teachers are also experimenting with new strategies such as group work, self-study, and interdisciplinary learning. One teacher said, "In the Plaza Classes we are teaching completely differently, and we are preparing the concepts for the lessons in a team. For example, we even teach grammar in a new way. The very first chapters in the textbook were transformed into assignments, and so the students had to gather the learning matter themselves." Another teacher described how the innovative thinking that is fostered within the Plaza Classes is beginning to spread beyond the dedicated space: "My experience with… the Plaza Classes has an impact on my 'normal' teaching style in other classes."

In some cases, new infrastructure and better usability have played a central role in catalyzing reform. For example, teachers whose classrooms have flexible furniture and open spaces say that the new facilities make it easier to facilitate collaborative learning. Similarly, teachers using laptops and interactive whiteboards say that these tools lower the barriers to student collaboration. The sidebar describes how these features are promoting new ways of thinking about teaching and learning at the Innovative School in Germany.

2.5 School-Level Change: Lessons Learned

In addition to demonstrating the importance of the major elements of the Innovation Framework, the experiences of the pilot schools provide a number of lessons that can help guide schools embarking on the process of adopting more student-centered teaching and learning. With respect to school-level change processes, this research suggests the following:

- Committed schools can find space for innovative teaching and learning even within traditional educational systems. In some countries innovation is particularly challenged by regulatory systems that emphasize coverage over depth or provide few school-level autonomies, but these schools have found ways to get started by providing bounded opportunities to experiment with new practices.
- Starting a school reform with willing teachers can avoid backlash and generate a record of success that lures more teachers into the effort. Teachers within a single school often begin with a wide range of enthusiasm and readiness for change. Some schools that chose a staged implementation, leveraging the excitement of early adopters, found that it was a way to demonstrate a positive path that other teachers were inspired to follow.
- Building professional learning communities around a reform effort improves teacher collaboration and school climate. In many countries, teaching is historically an individual practice. Given the complexity of the task of innovation, the pilot schools are finding that a supportive peer culture and focused processes for collaboration are essential.
- Both the introduction of technology and the opportunity to design new physical spaces for teaching and learning can catalyze a reexamination of teaching practices. In schools where tools and flexible learning spaces are accessible, teachers have found themselves inspired to think about the new ways of teaching and learning that these resources offer.
- With experience and proper supports, school staff members may come to view technology as a means to an end rather than an end in itself. Many of the pilot schools began with a vision for technology access and over time developed their visions for the learning opportunities that access can enable.

3. Teaching, Learning, and Assessment in the Pilot Schools

The ultimate goal of the Innovative Schools Program is the reinvention of teaching and learning to provide 21st century learning opportunities for students. Chapter 2 described school cultures, activities, and supports intended to provide a fertile environment for instructional innovation. This chapter turns to the classroom and describes instruction at the pilot schools and changes in instructional practices from Year 1 to Year 2.

In this evaluation, researchers used two lenses to provide a direct look at teaching and learning in the pilot schools. Researchers visited each school and observed classes, using a structured protocol that guided the collection of similar data across classes and countries to measure attributes of 21st century teaching and learning. In addition, teachers submitted actual samples of the assignments they gave to students and the work that students did in response. These samples were coded according to rubrics for 21st century teaching and learning that, again, allow similar criteria to be applied across instructional settings.[14] This chapter draws on both data sources, as well as qualitative reports from interviews with teachers and students, to describe teaching and learning at the pilot schools.

The chapter looks first at the overall character of teaching and learning in the pilot schools after 2 years and then at the frequency and character of students' technology use in the classroom. It concludes with a comparison of change over time. Because baseline data are not available for this study, this analysis compares the schools' practices at the end of Year 1 of participation in the Innovative Schools Program with their practices at the end of Year 2.

In interpreting the findings in this chapter, it is important to keep in mind the multiple challenges to implementing whole-school instructional change. Even in schools that have made important progress in establishing whole-school cultures and environments as described in Chapter 2, instructional reform remains a long-term process, and it is even more demanding in countries that have strong regulatory contexts and histories of traditional instruction. This chapter describes the steps that these schools have begun to take to offer new and inspiring learning opportunities to their students.

14 Details of both these methods are provided in the appendix.

Teaching, Learning and Assessment: Summary of Key Findings

- Overall, technology use among students in the pilot Innovative Schools increased significantly from Year 1 to Year 2 of the program.
- While the majority of technology use in pilot school classrooms still supports fairly traditional models, the proportion of technology-using classes that included at least some high-level technology use—for purposes such as data analysis and multimedia product creation as opposed to more rote uses such as practicing basic skills or word processing—increased significantly from Year 1 to Year 2. Because high-level technology use is associated with a broader range of observed innovative teaching practices, this is an important area of progress.
- In several schools, samples of student work that included student use of technology scored significantly higher on several 21st century skills—including Knowledge Construction, Skilled Communication, and Problem-Solving—than student work that did not include technology use.
- In schools where professional development programs strongly supported discussion and reflection on effective classroom uses of technology, researchers tended to observe more innovative applications of technology in teaching and learning.
- Overall in this research, students' work exhibited stronger 21st century skills in response to teacher assignments that called for those skills.
- The pilot schools vary widely with respect to innovative teaching and learning: some schools and teachers use a variety of innovative teaching practices, and others are just beginning to experiment with new ways of teaching.
- Collaboration among students is relatively common, and some teachers are experimenting with new assessment practices or providing more opportunities for student self-regulation. In most schools, a broad assortment of innovative teaching practices are not yet being seen school-wide.
- Overall pedagogical changes from Year 1 to Year 2 of the program were mixed: while some schools made progress in some areas, others stayed the same or lost ground in these early years of reform. Many of these differences are very small, and no significant change was detected overall on either quantitative measure. These results underscore the need for patience and support as teachers begin the long journey to adopting new practices in the classroom.

3.1 Overall Strength of Innovative Teaching and Learning

This section describes the overall findings from our analysis of classroom observations, teacher assignments, and student work in the 11 pilot schools. On the whole, schools are making progress in some areas of 21st century teaching and are still early in their implementation of others. We begin by describing the instruction that researchers observed when they visited classrooms at the pilot schools and then present the method and results of analyzing the learning assignments that teachers gave to students and the work that students did in response.

On the whole, schools are making progress in some areas of 21st century teaching and are still early in their implementation of others.

Innovative Teaching Practices in Observed Classrooms

This section describes results from classroom observations conducted by researchers in each country. Researchers were asked to observe eight lessons in each school[15]: three in humanities,[16] three in science, and two in any subject, with the latter selected to represent the school's best examples of innovative instruction. This is a small sample size, so although these data are reflective of instruction in each school, they cannot be taken as representative of all teachers or all classes.

To describe the overall strength of innovative teaching and learning at the pilot Innovative Schools, this report uses an index that was created from the classroom observation data. The classroom observation instrument was constructed to capture practices described as characteristic of innovative instruction and linked to positive student outcomes in the education reform literature (for example, Bransford, Brown, & Cocking, 1999; Darling-Hammond et al., 2008). The Innovative Teaching Index contains 13 of these practices that are associated with each other and hence form a reliable index (see sidebar). Lessons received 1 point for each of these practices that observers witnessed during the class, so for any given lesson the index could range from 0 (none of the practices observed) to 13 (all the practices observed). The lesson described for Bowring Community Sports College

Components of the Innovating Teaching Index*

- Students have opportunities to connect learning to their own lives or to the real world
- Students give feedback to other students or receive feedback from other students or the teacher
- Students work in small groups or pairs
- Students actively generate new knowledge
- Students work on an in-depth project
- Students get prompted to assess the state of their own learning
- Students revise their work based on feedback or self-assessment
- Students have choices about the tools/ resources used to learn
- Students engage in performance assessments or presentations of learning portfolios
- Students have choices about what they learn
- Students have opportunities to develop cross-cultural understanding
- Teachers evaluate and assess completed student work in a nontraditional way
- Teachers use technology to differentiate instruction

* In the Innovative Schools Program, student use of technology is an important component of 21st century learning environments. In their observations, researchers collected information on whether and how technology was used. However, this information is not included in the index to allow for analyses that compare the index score to technology use.

15 Because local conditions varied, not all researchers were able to conduct eight observations. The actual number of observations per school ranged from 2 to 10. Sample sizes for both years of data collection are described in the appendix.

16 "Humanities" included such subjects as native language studies, literature, history, and civics.

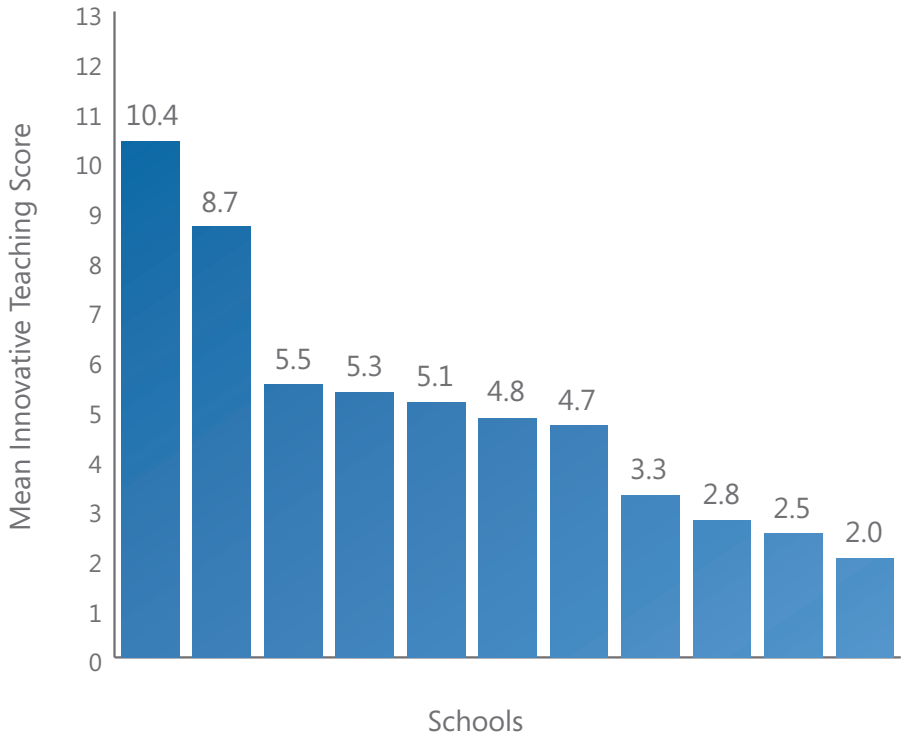
While sheer quantity of teaching practices is not the ultimate goal, this example illustrates the powerful learning environments that can be created when these elements work in synergy.

in the sidebar, for example, includes 11 of the 13 practices[17] and would receive a score of 11 on the index. While sheer quantity of teaching practices is not the ultimate goal, this example illustrates the powerful learning environments that can be created when these elements work in synergy.

Across all observations in Year 2 of the evaluation, the mean (average) score on the Innovative Teaching Index was 4.5. This means that on average between 4 and 5 of the 13 innovative practices were observed in a single class. Scores ranged from 0 to 13, but most lessons (51%) scored a 4 or below. The most frequent score was 2 (19%). To put this finding in perspective, note that researchers recorded only practices they actually observed during a single class period. An observed lesson might have been part of a larger project that would have included innovative practices, such as nontraditional assessments or giving students the opportunity to revise their work based on teacher feedback, at a later date; these later activities would not be included in the index score because they did not take place during the observed lesson. Even so, 20% of lessons scored 9 or higher. Thus, although the majority of observed lessons featured only a few innovative practices, a subset of teachers were using an impressive mix of innovative practices in their teaching.

Across schools, average Innovative Teaching Index scores varied substantially, from 2.0 to 10.4 (Figure 2). This variation by school underscores the diversity of circumstances and goals within the Innovative Schools Program: Although some schools have established expectations for the use of a range of innovative practices across all classrooms, others are just beginning to experiment with new methods in selected classes.

Figure 2. Mean Innovative Teaching Score by School (Year 2)



17 Only students' choice about what they learn and opportunities for cross-cultural understanding were not observed in this lesson.

Innovative Teaching at Bowring Community Sports College

As part of Bowring Community Sports College's extended multidisciplinary Space Academy, Year 9 (14-year-old) students design and test rockets in Discovery Time. A compelling event sets the tone for this activity, as the teacher takes the students outside to watch him launch one of the rockets built by students the prior year. With the school's rocket launcher, the simple cardboard and paper rocket shoots up high in the air, making an impressive noise. Students are instantly excited, and the teacher encourages them, "Yours will be even better." He takes the students back into class and uses a PowerPoint presentation to show the learning goals for the 2-week project. Students will work on being a Self Manager; the teacher explains that this means working toward their goals through planning and organizing time and resources. They will also work on Reflective Learner skills, which include assessing their own learning. Content area objectives in mathematics and science include Obtain Data and Consider the Sense of Your Results, Collect and Record Data, Calculate the Mean, and Understand How Forces Affect the Speed and Movement of an Object. The overall plan of the unit is for students to work in small groups designing and building rockets with the objective of building the one that stays in the air the longest. After students launch their initial rockets (three launches for each) and record air time, angles, and landing distance for each launch into a spreadsheet on their tablet PCs, all the data will be entered into a single spreadsheet and analyzed and discussed in class in order to develop insights about the factors associated with a long flight time. Students then use the knowledge they have developed through this experience in designing a second set of rockets, which they will launch and compare the next week.

This in-depth, 2-week activity incorporates many of the features in the Innovative Teaching Index. The launching their rockets and recording results connects learning to the real world. Students work on rockets in small groups of two to four and have choices about their designs and the materials to use in construction. Their tablet PCs have Internet access, giving them the option of using external information resources to inform their rocket designs. The teacher also uses technology to differentiate instruction. When he conducts this activity with older students who have had trigonometry, the students calculate the height of the rocket's trajectory themselves from the data they have recorded on the distance it lands from the launch point and the angle of the trajectory. For the younger students in the current class, the trigonometric formula is built into the spreadsheet in which they record their data. As they work on their rocket designs, students receive informal feedback and probing questions from their teacher. When they launch their initial rockets, the flight trajectory data give them real-world feedback about the relative success of their design. In-class discussion of the flight data for all the rockets helps the students construct knowledge about factors affecting the speed and movement of an object. Students then have the chance to use both the feedback and the new concepts they have assimilated in designing the second rocket. Their second rocket's performance is in essence a performance assessment, giving the students as well as the teacher an objective demonstration of how much they have learned. As with all learning activities at Bowring Community Sports College, the students also assess themselves on Personal Learning and Thinking skills, appraising their performance as Self Managers and as Reflective Thinkers at the end of each period.

Innovative teaching practices also varied within schools. On average, there was nearly a 7-point difference between the lessons with the highest and the lowest innovative teaching score within a given school. Some variation may be explained by subject matter. Humanities and the "other" classes selected by the schools as exemplars of innovative teaching scored higher on the index than science and math classes.[18] An implication for the design of strategies to support reform implementation is that they should take into account the differing pedagogical philosophies, experience levels, and subject matter specialties of teachers. One-size-fits-all professional development is not likely to benefit teachers who bring diverse skill sets and experiences to their teaching.

Progress on Specific Practices

Although the classroom observation data suggest that the average lesson incorporates only a few aspects of innovation, there is evidence that some elements of innovative teaching are becoming commonplace at many schools.

Table 5 shows how frequently researchers observed each of the practices in the Innovative Teaching Index across all lessons. The data show that certain innovative practices were observed more frequently than others. For example, in 70% of observed lessons, teachers gave students opportunities to make connections to the real world, but only in 20% of lessons did teachers promote the development of cross-cultural understanding. Feedback (65%) and group work (61%) were also common elements of the learning environment. Two features of the rigor of the instruction—students generating new knowledge and students working on in-depth projects—were judged to be present to some degree in roughly half of the observed lessons (both 49%). Nontraditional assessment and student choice about what and how to learn were less likely to be observed (20% and 23% of observations).

Table 5. Frequency of Innovative Teaching and Learning Practices

	N = 69 Lessons	
	Count	**%**
Students have opportunities to connect learning to their own lives or to the real world	48	69.6
Students give feedback to other students or receive feedback from other students or the teacher	45	65.2
Students work in small groups or pairs	42	60.9
Students actively generate new knowledge	34	49.3
Students work on an in-depth project	34	49.3
Students get prompted to assess the state of their own learning	27	39.1
Students revise their work based on feedback or self-assessment	27	39.1
Students have choices about the tools/resources used to learn	23	33.3
Students engage in performance assessments or presentations of learning portfolios	16	23.2
Students have choices about what they learn	16	23.2
Students have opportunities to develop cross-cultural understanding	14	20.3
Teachers evaluate and assess completed student work in a nontraditional way	14	20.3
Teachers use technology to differentiate instruction	5	7.3

18 The mean scores were 5.08 for humanities, 3.38 for math and science, and 6.34 for "other" classes. The "other" classes chosen to represent innovative practice were statistically different from the math and science classes at the .01 level.

Collaboration is one element of innovative practice that pilot schools have applied with greater frequency and depth. In most schools, sharing work and ideas is a common feature of the learning environment. In 61% of the observed lessons, group work was featured to some degree, and group work was the main activity structure[19] observed in 38% of classrooms, more common than other activity structures such as teacher-led instruction or individual work. One Innovative Schools Program teacher commented, "Group work is now a matter of course for the students."

In classes that exhibit higher levels of collaboration, students work together on extended projects, share responsibility for assignments, and even create interdependent products. The sidebar describes an example of strong collaborative work among students at the pilot Innovative School in Mexico.

Students are also becoming agents of their own learning at many pilot schools. In interviews, some teachers and school leaders commented that students were more autonomous and independent than before. The integration of project-based learning in many schools has increased students' responsibilities for keeping track of their tasks and progress, often at least a week at a time. In addition, teachers who are adopting these practices say that students are more willing to apply their critical thinking skills to problems that they do not have an answer to. According to one teacher, "Traditionally, when students encountered problems they would just tell us that they did not know how to do it. But now they will try to find different ways to solve the problem and discuss with their peers first."

Researchers also found evidence that teachers are making some changes in their assessment processes. Changing assessment practices is challenging; local and national policies play a role, as do school-level decisions and the efforts of individual teachers in the classroom. Consequently, most pilot Innovative Schools are undertaking only certain elements of assessment reform. Their efforts include conducting and applying action research on assessment practices; using formative, peer, and self-assessment to a greater degree; and harnessing technological tools to promote new assessment strategies.

19 "Main activity structure" is defined as the type of activity that the most students were doing for the most time during the observation period.

In most schools, sharing work and ideas is a common feature of the learning environment.

Collaborating and Applying Learning to the Real World

At Escuela Secundaria Tecnica #12 in Mexico, students engage in school-wide projects every two months. During one project on ecology, a group of students worked together to produce a local radio program about the environment. They received airtime from a local radio station and broadcast their project to the community. In addition, the radio producers joined them for their school-wide presentation to parents. Completing the project required students to create joint products, apply their learning to the real world, and use global tools.

Students Taking Responsibility for Learning

At the Fung Kai Innovative School in Hong Kong, the use of the digital curriculum, which is available to students on their netbook computers, has facilitated students' interest in taking responsibility for their own learning. According to teachers, students often take the initiative to download the next mathematics lesson in advance to prepare themselves for their next class. With the new curriculum, students also are also more likely to review vocabulary and work on areas needing improvement. "It makes learning easier," said one student.

At École Chateaudun in France, students are learning to work autonomously on their projects. In one class, students have learned a set of guidelines for autonomous work: "cooperating, whispering, being organized, and sharing tasks." They implement these guidelines while they work in groups, managing their work without strict rules from the teacher about what they should do at any given moment. Teachers and parents agree that students are now more independent in their work than before.

Moving forward, the challenge for pilot schools will be to integrate innovative practices on a more systemic level.

Five Dimensions of 21st Century Teacher Assignments

- **Knowledge Construction.** The activity calls on students to move beyond the reproduction of information to build knowledge that is new to them.
- **Collaboration.** The activity requires students to work with others, either face to face or through technology, and produce products that are interdependent.
- **Problem-Solving and Innovation.** Students are asked to design a complex product with a set of constraints or address a significant issue or solve a problem without a previously learned procedure and make choices about the problem to address and how to solve it. Students are asked to innovate when their solution provides benefit in the real world for an audience other than the teacher as grader.
- **Self-Regulation.** The activity lasts for a week or more and has multiple stages or parts; students are given assessment criteria in advance so that they can assess their own work; and students revise their work based on feedback from the teacher or from other students.
- **Global Tools and Perspectives.** The activity resembles the 21st century workplace in that a wide range of resources are used. It involves knowledge and methods from multiple academic disciplines, incorporates data or perspectives from multiple countries or cultures, and is supported with technology tools.

For example, some teachers report that they are giving and receiving more frequent interim feedback during the learning process: polling students about their knowledge on a topic, asking for assignment drafts, and providing students with informal feedback. Such practices may allow students to readjust their own learning paths and concentrate on areas where they need further development. Peer and self-assessment are also emerging practices in the pilot Innovative Schools. In one school, students rate themselves on competencies using a system of happy faces. Although the "smiley system" ultimately does not factor into grading, it allows students to develop self-awareness about their own learning. Furthermore, some teachers have found technology to be a tool for changing assessment practices. It can be challenging to assess students more frequently and to assess transferable skills as well as subject-specific knowledge. But with video and media capabilities, electronic polling and grading, and web portals that foster information sharing, some technology-enabled Innovative Schools have been able to integrate new assessment practices into their curriculum.

Other features of innovative teaching have been elusive. For example, in pilot school classrooms, the extent to which students have choices about their learning varies greatly: Most classes offer very little choice or offer choice only in limited ways. Moving forward, the challenge for pilot schools will be to integrate innovative practices on a more systemic level.

21st Century Teaching and Learning in Teacher Assignments and Student Work

A second measure of the innovative nature of classroom instruction comes from the analysis of samples of teacher assignments and student work from pilot Innovative School classes. In each school, 6 teachers[20] were each asked to submit 6 samples of the learning activities they assigned to students over the course of the school year and samples of the work that students did for 2 of those assignments. In Year 2, a total of 250 assignments and 835 pieces of student work were collected from 54 teachers in the 11 countries. The data collection focused on humanities and science subjects, and students of approximately age 10 (for primary schools) or age 15 (for secondary schools).

These artifacts of actual classroom practice were then coded by teachers recruited from other local schools according to a set of rubrics created by SRI to describe the essential components of 21st century teaching and learning.[21] Following the rubrics, coders scored each assignment and piece of student work on dimensions that described the degree to which assignments provided 21st century learning opportunities (five dimensions of 21st century teacher assignments) and the degree to which student work demonstrated the related 21st century skills (four dimensions of 21st century student work).

For each assignment or piece of student work and each dimension, coders were asked to assign a score from 1 to 4, where 1 indicated that the dimension was not demonstrated at all and 4 indicated that it was demonstrated to a strong degree. The examples in the sidebar describe assignments at the pilot Innovative Schools that would have received a high score on each dimension.

The rubrics are challenging by design: Higher levels represent ambitious goals for teaching and learning that most schools do not yet reach. They are intended to inspire and inform as well as to be used as measurement tools. As a result, we would not expect to see a many high scores at this stage in the reform.

20 Again, this is the target number of teachers; the actual sample varied according to local circumstances, as described in the appendix.

21 These rubrics were developed on the basis of input from the pilot Innovative Schools and previous research using this method (Bryk, Nagaoka, & Newmann, 2000; Matsumura & Pascal, 2003; Mitchell et al., 2005).

Four Dimensions of 21st Century Student Work*

- **Knowledge Construction.** The work demonstrates that the student has created or explored information or ideas through investigation, interpretation, analysis, synthesis, or evaluation.
- **Problem-Solving and Innovation.** The work demonstrates problem solving by addressing a problem or an issue with no known answer or by designing a product that meets a set of constraints, is creative in that it makes unexpected connections across ideas or is original in design, and qualifies as innovation because it has been implemented in the real world.
- **Skilled Communication.** The work contains extended writing that is well developed, contains sufficient relevant evidence to support a theme (for secondary students) or topic (for primary students), and is coherent and well organized.
- **Global Tools and Perspectives.** The work reflects the use of knowledge and methods from multiple academic disciplines, incorporates perspectives or data from multiple cultures or countries, and reflects the use of technology tools.

* Student work was not coded on quality of collaboration or self-regulation because these processes cannot be seen clearly in students' work products.

Examples of High-Scoring Teacher Assignments

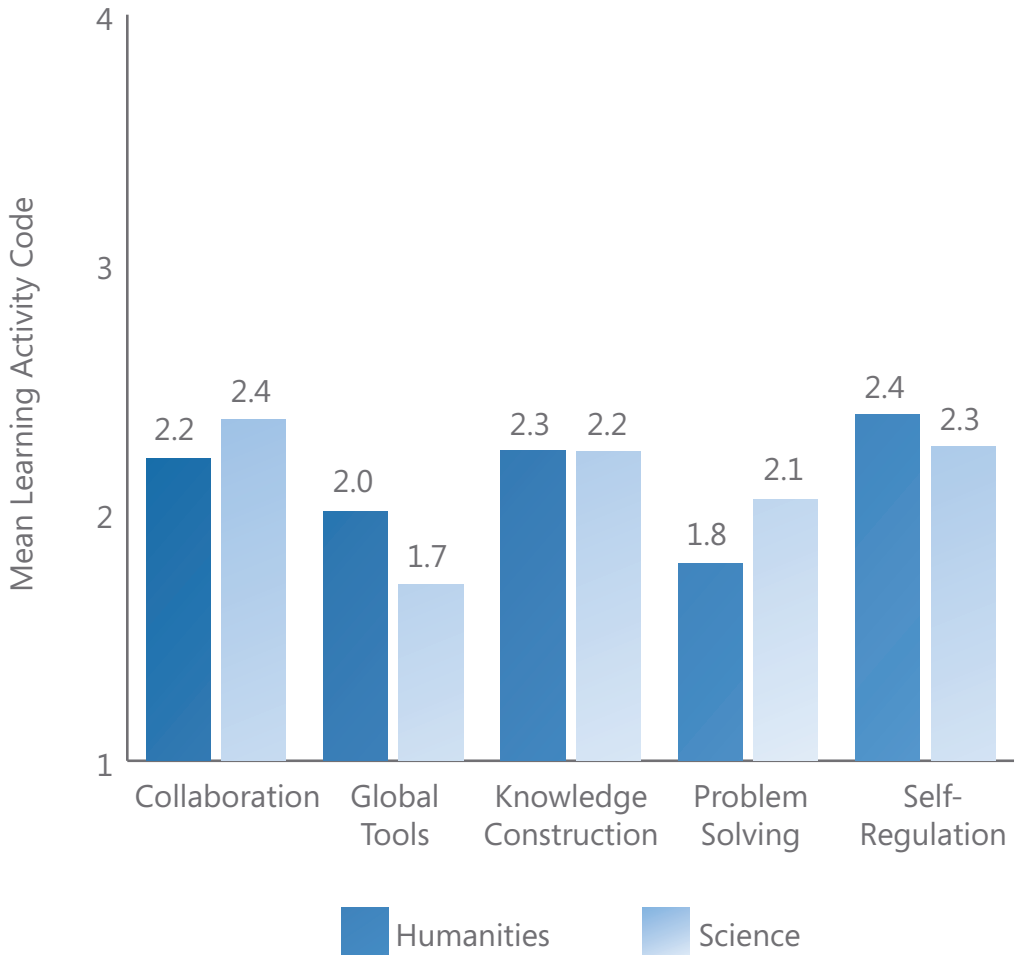
- **Knowledge Construction:** History students worked on an assignment that required them to understand and analyze the origin of cities in their country and how city creation relates to the conquest process. This assignment required students to develop new insights into a topic important to the discipline, so it would score a 4 on Knowledge Construction.
- **Collaboration and Self-Regulation:** Students worked in groups on presentations and reports on ancient civilizations. They were asked to each work on different parts of the presentations and reports, which they would bring together into a coherent whole at the end. Because students were working together on an interdependent product, this assignment would score a 4 on Collaboration. Because it was a long-term project and students were required to create a self-assessment tool, the assignment would score a 3 on Self-Regulation.
- **Problem-Solving and Innovation:** Secondary students studying the Vietnam War had to create arguments on the statement, "The massacre at My Lai can never be justified." Students were required to craft arguments both agreeing and disagreeing with the statement, using their choice of a variety of primary sources—film clips, newspaper articles, and even popular song lyrics from the era. Because of the requirement to develop an answer to a problem that was new to them and because of the choices students had in how to do their research, this assignment would receive a 3 for Problem-Solving and Innovation. Because students did not have to put their ideas into practice in the real world, it would not receive a 4.
- **Global Tools:** Primary school students were assigned to create projects based on a dance performance. Their work was to incorporate concepts from dance as well as language because their final products would involve extended writing. Students also used technology, including use of audio software to create radio reports of their written work. However, the projects were not multicultural. This assignment would receive a score of 3 for Global Tools.

Figure 3 displays results for teacher assignments across all dimensions and subjects for the Year 2 sample. Across all five dimensions, the average score given to teacher assignments was approximately 2, with slight variation observed across dimensions. These measures suggest that the average humanities and sciences assignments in pilot Innovative Schools at this early stage of the reform do not call for 21st century learning to a great degree. Examples of instruction that illustrate these typical scores are described in the sidebar.

Across subjects, humanities assignments earned higher scores, on average, than science assignments on two of the five dimensions: Global Tools and Self-Regulation. On the dimensions of Collaboration and Problem-Solving, science assignments scored slightly higher. Differences across disciplines were relatively small, however, and most were not statistically significant.

These measures suggest that the average humanities and sciences assignments in pilot Innovative Schools at this early stage of the reform do not call for 21st century learning to a great degree.

Figure 3. Mean Teacher Assignment Scores, by Subject Area (Year 2)



Examples of "Typical" Assignments

- **Global Tools:** Primary school students are creating reports on newspapers and how they work. They have visited a newspaper office and also learned in science class about paper and ink. Their report will contain content from multiple disciplines—science and journalism are both topics of instruction—but the task is not multicultural and students are not using technology to create their projects. Thus, it would receive a 2 in Global Tools.
- **Collaboration:** Students are assigned to do individual presentations, but they are allowed to talk and share ideas with one another as they work. This assignment would score a 2 on Collaboration because collaboration is allowed but not required.
- **Knowledge Construction:** Students create presentations on different topics related to industrialization. There is some analysis of primary documents, but for the most part students simply pull information from the Internet into their presentations. Because Knowledge Construction is included but is not the main requirement, this assignment would score a 2 on Knowledge Construction.

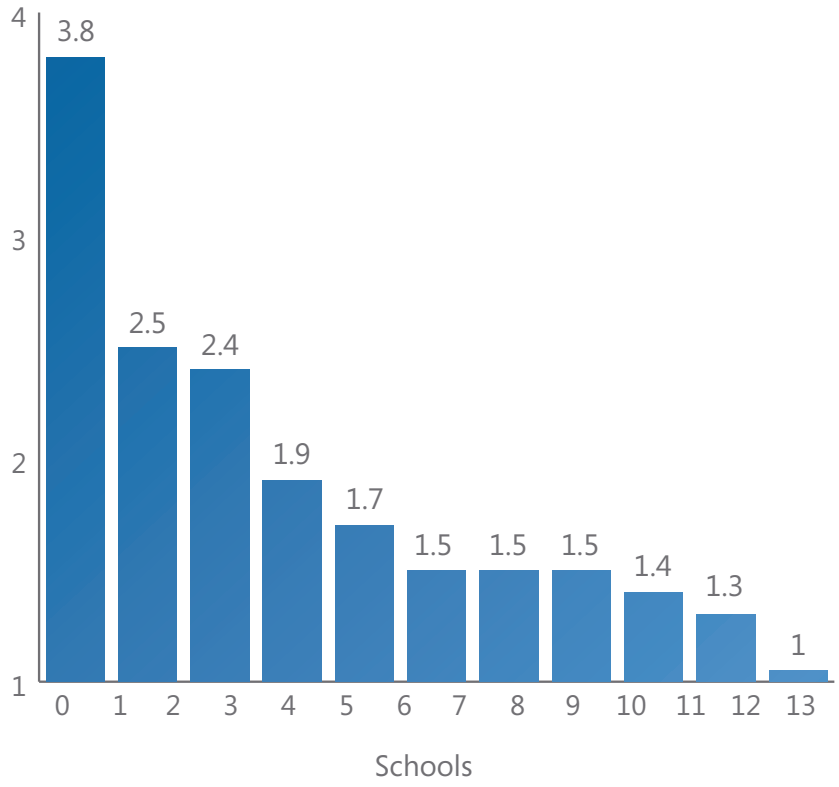
As is the case with the Innovative Teaching Index, the overall mean for teacher assignment ratings masks considerable variation across schools and teachers. This variability can be illustrated by the mean teacher assignment scores for Problem-Solving and Innovation. Figure 4 shows that mean scores for given schools range from well over 3 (meaning that most assignments scored high on this dimension) to 1 (meaning that students at this school were not asked to do any problem-solving in any of the assignments that were collected).

Analysis of student work paints a comparable picture of the status of innovative learning in the pilot schools. Mean scores for student work hovered just below 2, with small differences observed across the dimensions. Differences by subject, shown in Figure 5, were somewhat more pronounced in student work than they were in teacher assignments. In a pattern that echoed the data from the teacher assignment analysis, student work in science tended to score lower than in humanities on Global Tools, and science work scored higher than humanities work on Problem Solving. Humanities classes also scored a full half point higher, on average, than science classes on the Skilled Communication dimension, which is not surprising because students are typically asked to do more extended writing in humanities classes than in science.

Not surprisingly, statistical analysis showed that scores on teacher assignments predicted scores on student work. In other words, student work that exhibits higher levels of 21st century skills is typically done in response to teacher assignments that call for the application of those skills. These results were highly statistically significant. This relationship was also found in other research using similar methods (e.g., Newmann, Lopez, & Bryk, 1998) and demonstrates the importance of the quality and characteristics of the learning activities that students are asked to do as parameters that shape their learning.

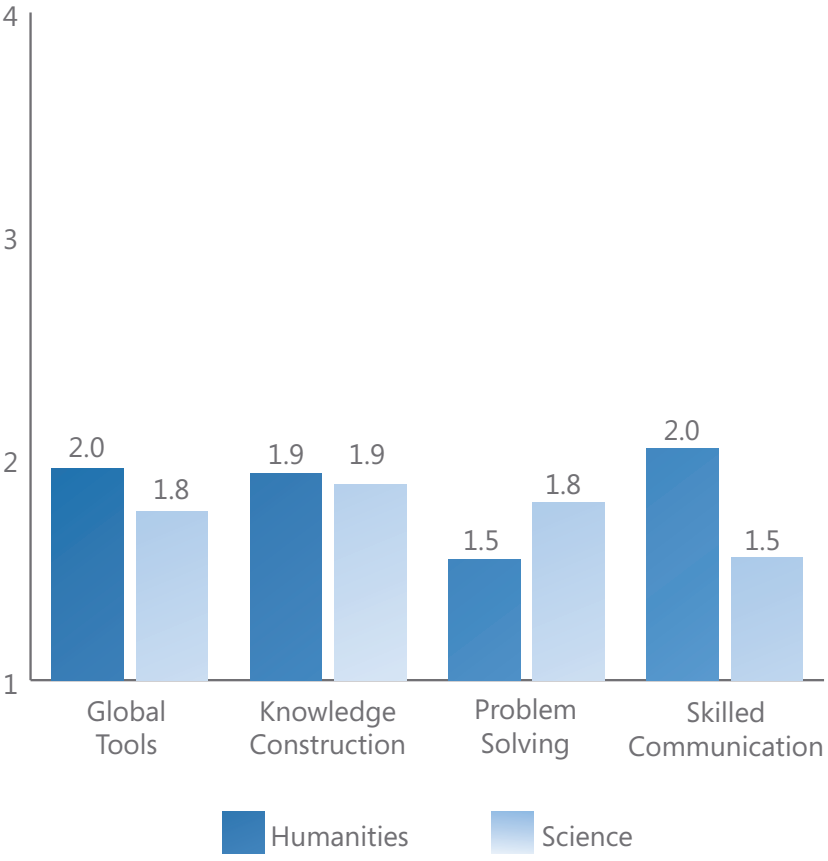
There were also some exceptions in the data. One country had the third highest average score among the 11 pilot countries across dimensions for teacher assignments but ranked 10th among the 11 countries on student work. This suggests the importance of teachers not only writing assignments that call for innovative work from students, but also reinforcing these requirements in the way they work with students. Designing innovative teacher assignments is important but it is only a first step toward promoting 21st century learning. Teacher activities in the classroom and the guidance and coaching they provide students are also important facilitators of the learning experience.

Figure 4. Mean Teacher Assignment Scores for Problem-Solving and Innovation, by School (Year 2)



Student work that exhibits higher levels of 21st century skills is typically done in response to teacher assignments that call for the application of those skills.

Figure 5. Mean Student Work Scores, by Subject Area (Year 2).



In Year 2, of those lessons in which students used technology, they used it in at least some high-level ways in 81% of lessons.

3.2 Use of Technology in the Classroom

As noted in Chapter 2, many of the pilot schools improved their technological infrastructure during the 2 years of the Innovative Schools pilot program with the goal of increasing student and teacher use of technology to support learning. In 58% of observed classes, technology was being used by students, suggesting that it has become a regular part of instruction in many of the pilot schools.

Interviews of school leaders, teachers, and students also suggested that technology use has been commonplace in teaching and learning in some schools. One student said of technology use in her classroom, "It is so natural to use—it's just part of the day." Another said that now "We have computers in every single classroom and we can use them freely for our classes." A teacher said technology was "totally integrated" into his practice. Although these statements are not representative of all schools or of all teachers and students within a school in all cases, they do indicate that technology use is becoming prevalent in some places.

Just the use of technology does not necessarily imply innovative teaching practices, however. New tools can easily be used to automate traditional methods of teaching (Campuzano et al., 2009; Law & Chow, 2008). For this reason, classroom observations distinguished the purpose technology was being used for. Basic-level uses included such activities as using drill-and-practice software, word processing, and looking up information on the Internet. High-level technology uses included such activities as organizing or analyzing data, designing a multimedia product, collaborating or communicating online, assessing progress, or managing learning.

In Year 2, of those lessons in which students used technology, they used it in at least some high-level ways in 81% of lessons. Only 19% of lessons involving technology limited students to basic uses. In many lessons, students used technology in both basic and high-level ways. Dominant student uses of technology[22] are discussed below.

How Technology Is Used

Although most observed lessons involving technology included some high-level uses, the most common teacher and student uses of technology remained fairly traditional. For teachers, by far the most common use of technology was giving instruction and presenting information (in 57% of all observed lessons and the dominant teacher use of technology in 44% of lessons). All other teacher uses of technology (including differentiating instruction, communicating with students, demonstrating student uses of technology, giving tests or quizzes, and conducting class administration) were found in less than a quarter of the lessons observed.

22 Evaluators were asked to identify all student and teacher uses of technology and also to select the one they considered the "dominant" or primary use of technology during the observed lesson. For example, if students conducted Internet research for 5 minutes and then spent 30 minutes typing a report in a word processing program, word processing would be the dominant use of technology.

Table 6 shows the dominant uses of technology for lessons in which students used technology. The three practices categorized as "basic use" are three of the most common uses of technology. High-level student uses of technology were rarely the dominant use, but those practices are occurring. For example, students used technology to organize, manipulate, or interpret data in about as many lessons as they used technology to practice skills or learn basic information, but using technology to practice basic skills was the dominant use of technology in 40% of lessons. In contrast, the high-level use of organizing, manipulating, or interpreting information was dominant in only 13% of lessons. Thus, teachers may be experimenting with new practices, but they still use more familiar uses of technology for a larger portion of their lesson time. This finding suggests that teachers have yet to shift the main focus of their students' work with technology from more basic to more innovative activities.

Teachers have yet to shift the main focus of their students' work with technology from more basic to more innovative activities.

Table 6. Dominant Student Uses of Technology

	Of lessons in which technology was used, **percentage in which the practice was the dominant student use of technology**
Basic learning purposes	
Practice skills or learn basic information	40
Research or access information	30
Create documents/presentations or publish results	27
High-level learning purposes	
Organize, manipulate, or interpret data/information	13
Design and create multimedia products	10
Manage a project or own learning process	7
Assess own/peers' performance	3
Communicate with experts outside the class	0
Collaborate with other students and the teacher in the class	0

In this sample of lessons, researchers observed only a handful of convincing examples of technology being used in truly innovative ways—enabling activities that could not happen without the technology. The qualitative data, however, offered some valuable descriptions of how educators could use technology to enable students to do something new. In one classroom, students embedded videos they found on YouTube into a glossary they were creating, enlivening a task that otherwise might have been rote and making an end product that could provide richer, more comprehensible definitions of words for users. Students in several pilot schools used learning management platforms to access school documents

from home, to review their peers' work, and to hold discussions outside class time. Teachers in several classes showed visualizations that brought to life concepts like DNA replication and soil erosion; students noted that the displays made the content easier to understand than diagrams and photographs in the textbook did.

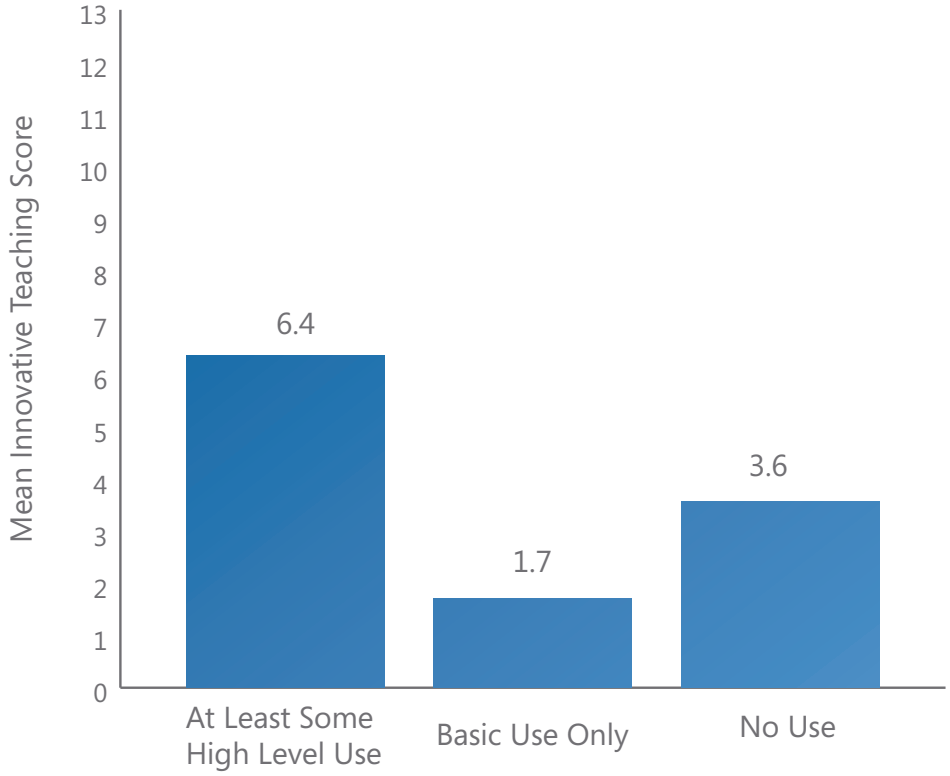
Another qualitative finding from classrooms was that better access to technology corresponded to higher level technology use. On the basis of the reported quantity, variety, and reliability of ICT in the classroom, SRI assigned ratings of low, medium, or high ICT access to each of the Innovative Schools. Low-access schools were characterized by access limited to computer labs or contextual factors that made access a clear problem, and high-access schools were characterized by an organized program that offered strong ICT access. Although the four low-access schools in the sample incorporated high-level technology use into 0% to 25% of observed lessons, the three high-access schools did so for 62.5% to 100% of observed lessons. In other words, teachers in schools that had a wide variety of available ICT were more likely to use it for high-level purposes. These findings are consistent with a large body of literature (see, for example, Cuban, 2001) suggesting that successful integration of ICT into classrooms depends heavily on removing barriers to use. As a teacher in one school explained, "[Our] use of ICT is linked to availability and access to ICT."

Implications of Use of Technology for Learning

The data presented above clearly indicate that many of the Innovative School teachers are using technology in their classrooms and are in some cases incorporating high-level uses into their instruction. Here we explore whether teaching that incorporates student use of technology exhibits the desired properties of innovative instruction.

Not all types of technology use are likely to be associated with innovative teaching (Means, Penuel, & Padilla, 2001). For example, using technology for drill and practice of basic skills is probably not strongly related with 21st century teaching and learning as we have defined them in this report. We compared the mean (average) Innovative Teaching Index scores for lessons in which students used technology for at least some higher level tasks, lessons in which students used technology exclusively for basic tasks, and lessons in which students did not use technology (Figure 6).

Figure 6. Mean Innovative Teaching Score, by Level of Technology Use (Year 2)



The mean Innovative Teaching Index score is higher for lessons in which students used technology for at least some higher level purposes than for lessons in which students used technology only for basic purposes or did not use technology at all.

The figure shows that the mean Innovative Teaching Index score is higher for lessons in which students used technology for at least some higher level purposes than for lessons in which students used technology only for basic purposes or did not use technology at all. These differences are statistically significant ($p < .01$ and $p < .05$, respectively) and replicate relationships found in the Year 1 evaluation data.

Use of technology is also associated with scores on some of the 21st century teaching and learning dimensions on which teacher assignments and student work were coded. Teacher assignments that encouraged students to use technology were associated with higher levels of Collaboration, meaning that when teachers encouraged technology use, they were also more likely to allow or require students to collaborate on their work. This association is statistically significant. Analyses of the relationship between technology use and the teacher assignment scores within individual schools also suggested that these features can be mutually reinforcing. Use of technology was associated with higher scores on one or more of the rubrics in nine schools; it was associated with lower scores on one or more rubrics in just two schools. In some schools, encouraging use of technology was significantly associated with higher scores on several additional rubrics, including Self-Regulation, Knowledge Construction, and Problem-Solving and Innovation, in addition to Collaboration. Similarly, use of technology by students as seen in samples of

student work was associated with higher scores in Knowledge Construction, Skilled Communication, and Problem-Solving in several schools.[23] Understanding these relationships would require further research with a larger sample size.

These data suggest that increases in technology use, particularly high-level use, may have benefits beyond simply developing students' ability to use computers well. They may also be developing other 21st century skills if teachers are giving assignments that call for these skills in addition to the use of technology.

Supports for Strong Usage

Although the data provide evidence of a relationship between high-level uses of technology and innovative teaching in pilot school classrooms, they do not tell us why these two variables tend to appear together. The qualitative data collected from interviews of teachers and students suggest that strong professional development programs are connecting technology use with other aspects of innovative teaching.

As mentioned earlier, several of the pilot schools have focused their professional development efforts not just on technology skills for teachers, but also on how teachers can use technology effectively in the classroom. The countries in which these professional development programs are strongest are generally also the countries in which researchers saw or heard about more innovative uses of technology in the classroom. For example, in one class students worked in groups to create comic strips using a particular software program. Their comics had to include digital photographs taken by the students, so the students took photos, uploaded them, and inserted them into the comic strip as appropriate. While students worked, the teacher played a tech support role rather than directing their work. Students held the decision-making power regarding what they included in the comic strips and how they proceeded. In another class, students answered the teacher's questions using the chat feature on SharePoint, where they also commented on one another's work. In a third, students conducted research and created PowerPoint presentations that were to be used to teach other students about their topics. The presentations were often multimedia, using embedded video and music clips to make the learning experience more lively for the audience. These examples incorporate high-level uses of technology as well as features of innovative teaching such as student choice and provision of feedback. They all occurred in schools where professional development offerings and learning communities focused on pedagogy as well as technology and offered opportunities for teachers to reflect on how new tools can enable new opportunities for learning.

23 Again, some examples of use of technology were associated with lower scores on dimensions of 21st century learning in particular schools. However, it was more common that use of technology was associated with higher scores.

3.3 Changes in Teaching and Learning from Year 1 to Year 2

Student technology use increased from the first year of the program to the second.

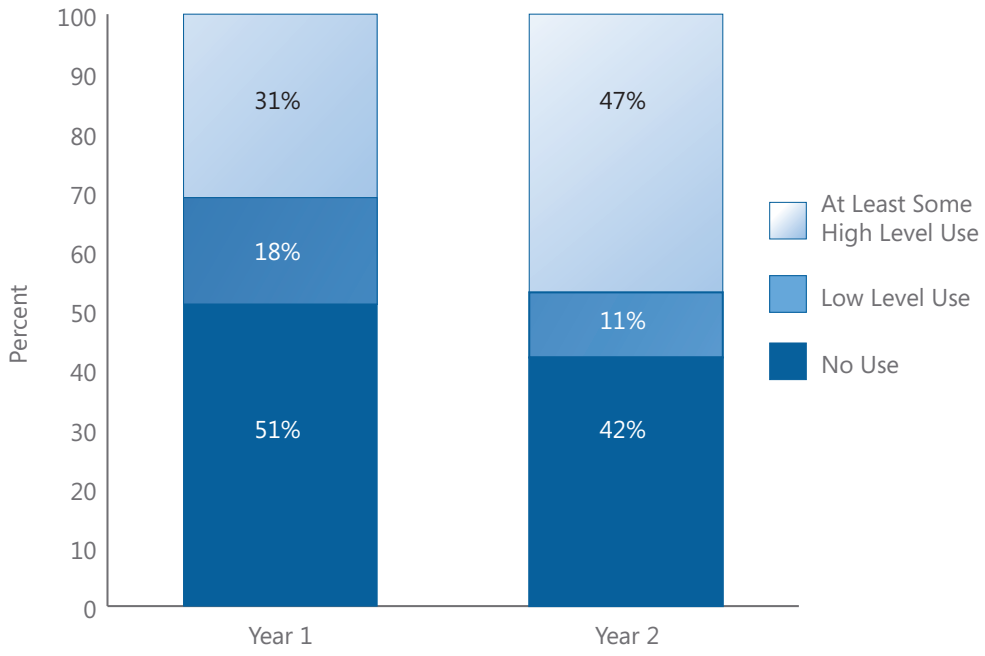
This section of the report examines changes from Year 1 to Year 2 of the Innovative Schools Program. The data reported were collected in spring 2008 and spring 2009, after the schools had been participating in the program for 1 and 2 years, respectively. As a result, available measures do not capture any changes that may have occurred during the first year of the program. Some schools reported in spring 2008 that they were beginning to experiment with new instructional practices; these steps are not reflected in the results that follow.

Changes in student technology use from Year 1 to Year 2 are discussed first, followed by a description of changes in innovative teaching practices more broadly.

Changes in Student Technology Use

Given the investments that many of these schools have made in technology infrastructure and their goals to explore technology-supported teaching and learning, one of the first areas in which we might expect to find significant change between Year 1 and Year 2 is in the use of technology. Figure 7 shows that across classroom observations at all 10 pilot schools included in this analysis,[24] student technology use increased from the first year of the program to the second. The percentage of observed lessons in which students used technology increased from 49% in Year 1 to 58% in Year 2.

Figure 7. Student Technology Use, by Level and Year



24 The school in Finland was not yet open at the time of this evaluation, so observation data were collected only in Year 2 in classrooms of other local teachers for possible later comparison with practices in the Innovative School once it exists. Data from Finland are not included in any analyses of change over time in this report.

High-level technology use tends to be associated with other innovative teaching practices, suggesting that this increase might be a precursor to other positive changes in teaching and learning.

In addition, the percentage of observed lessons in which students used technology for at least some high-level purposes increased from 31% in Year 1 to 47% in Year 2.[25] This change is statistically significant ($p < .05$). By the second year of the program, students in nearly half of the observed lessons were using technology for at least some high-level learning purposes.

Qualitative data from the school interviews may help us understand the basis for this progress. As noted Chapter 2, professional development during the first year of the Innovative Schools pilot often stressed the basics of how to use the technology that was being introduced. In the second year of the program, the emphasis of professional development in some schools began to shift to how technology can be integrated with instructional goals to support learning. This increased support for technology integration in some schools may be reflected in the increase in high-level technology uses that researchers observed in classrooms.

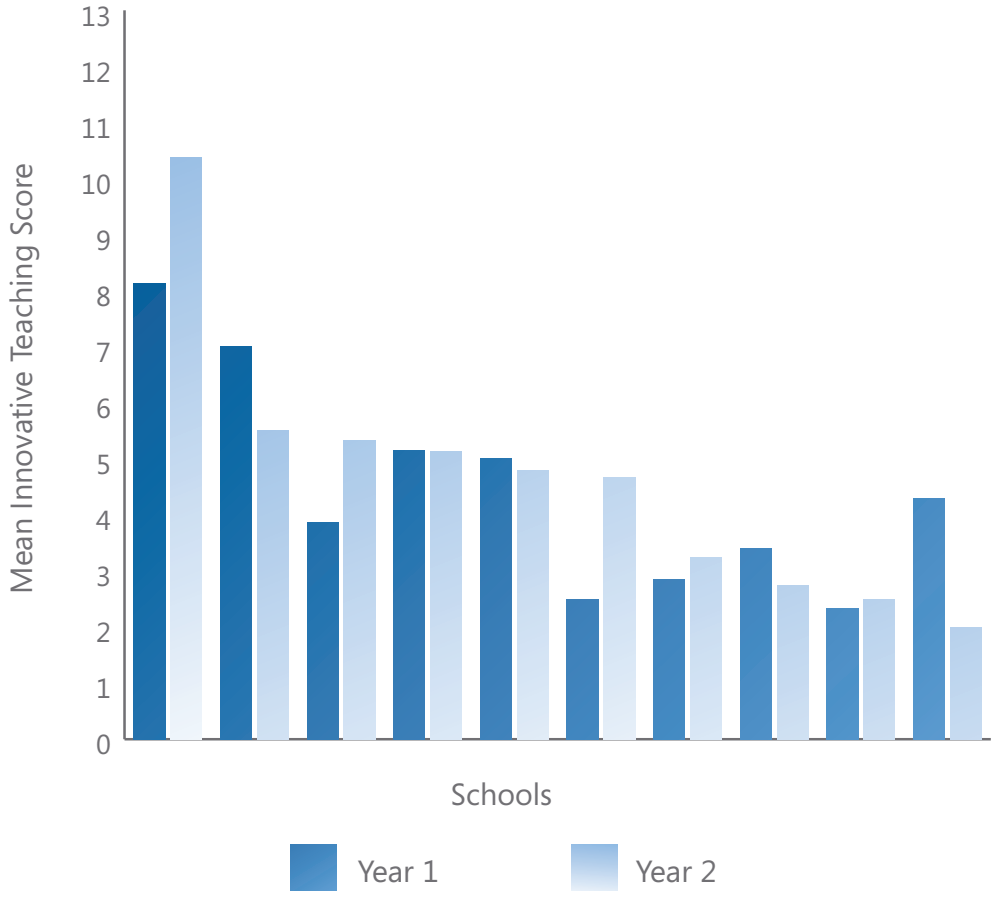
As reported earlier in this chapter, high-level technology use tends to be associated with other innovative teaching practices, suggesting that this increase might be a precursor to other positive changes in teaching and learning. We turn now to measures of innovative teaching overall, looking for changes in teaching practice more broadly from Year 1 to Year 2.

Change on the Innovative Teaching Index

Classroom observation data were used to construct the Innovative Teaching Index as an overall measure of innovative teaching and learning. Figure 8 shows the average index scores in Years 1 and 2 in each of the 10 pilot schools that had available data for both years. The number of innovative practices observed in any one class period increased in three countries; it also decreased in three countries and stayed about the same in four. Most of these changes were small: They were statistically significant only for the two countries with the largest increase and the largest decrease, respectively.

25 High-level technology use includes such activities as organizing or analyzing data, designing a multimedia product, collaborating or communicating online, assessing progress, or managing learning. Basic-level technology use includes such activities as using drill and practice software, word processing, and researching information on the Internet. Researching information was considered a basic use because classroom descriptions provided with the classroom observation data revealed that students generally used the Internet to look up information quickly in lieu of using a dictionary or encyclopedia rather than using the Internet as part of a complex research task. This categorization is the same one that was used in analysis last year.

Figure 8. Mean Innovative Teaching Score, by School and Year



Although some movement on this index occurred in individual countries, there was no change on average in the strength of innovative teaching practices from Year 1 to Year 2.

Although some movement on this index occurred in individual countries, there was no change on average in the strength of innovative teaching practices from Year 1 to Year 2. The program-wide mean scale score across all participating teachers in Year 1 was 4.8 and the mean scale score in Year 2 was 4.5; this difference was not statistically significant.[26] Individual teachers may have used significantly more (or fewer) innovative teaching practices in their classrooms, but these overall results indicate there was no detectable net difference in this measure of teaching practices across the 10 schools.

Changes in Teacher Assignments and Student Work

Similarly, data from teacher assignments and student work suggest no significant change overall between Year 1 and Year 2 of the pilot program. Figures 9 and 10 show overall teacher assignment scores in the humanities and science; findings for student work were similar.

26 We also analyzed the data for the subset of teachers who participated in the evaluation in both years of the study to see whether the results differed for teachers known to have participated in the reform for multiple years. However, the results were not substantially different from those of the overall sample. We are reporting the results from all participating teachers because they provide a larger sample and thus more reliable data.

Figure 9. Overall Teacher Assignment Scores in Humanities, by Year

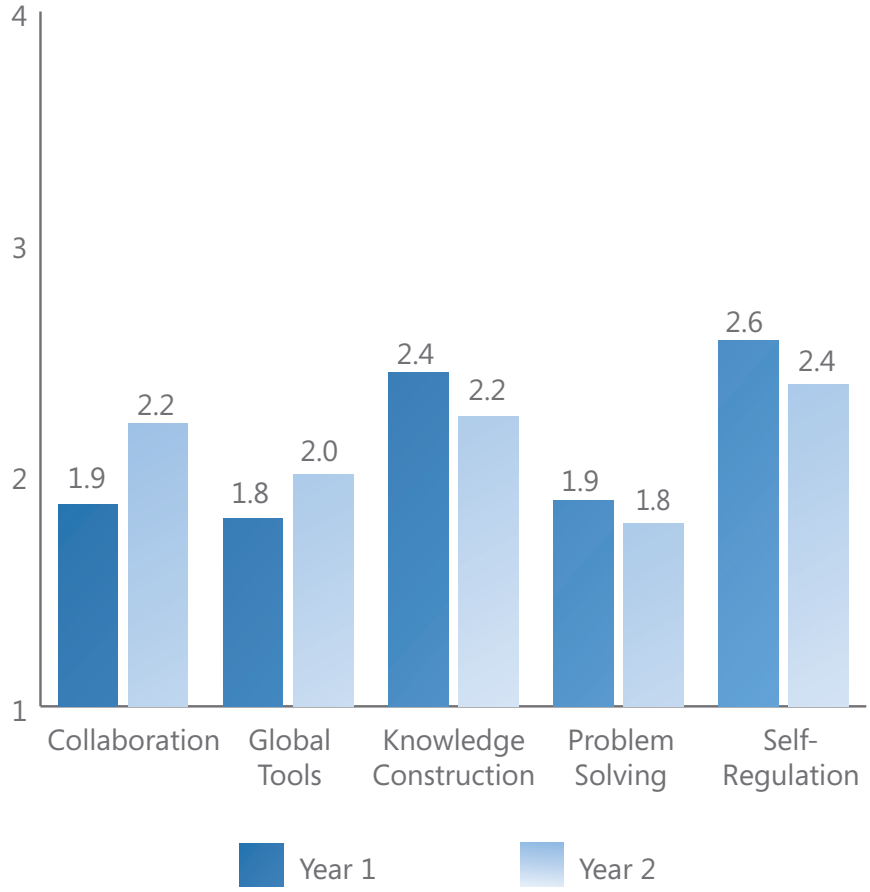
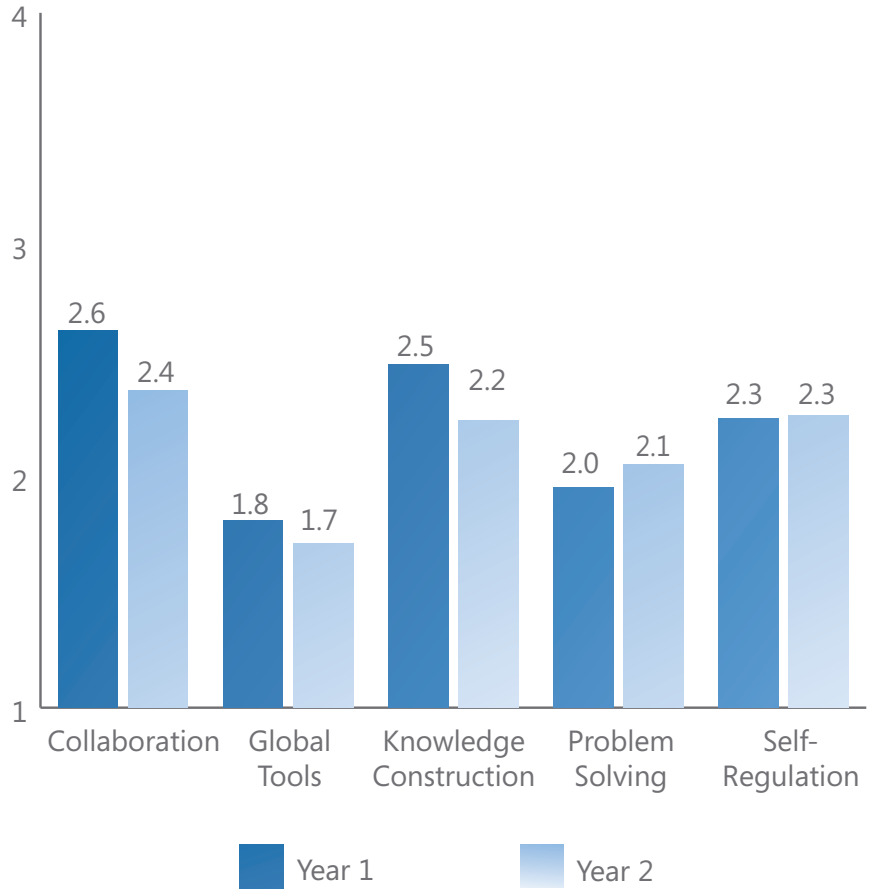


Figure 10. Overall Teacher Assignment Scores in Science, by Year



As was the case with the classroom observation data, examining changes in teacher assignment and student work scores in individual schools highlights the variation that exists across schools and provides one explanation for a lack of change throughout the program overall. While two schools had increases in all dimensions, most schools increased in some areas and decreased in others.

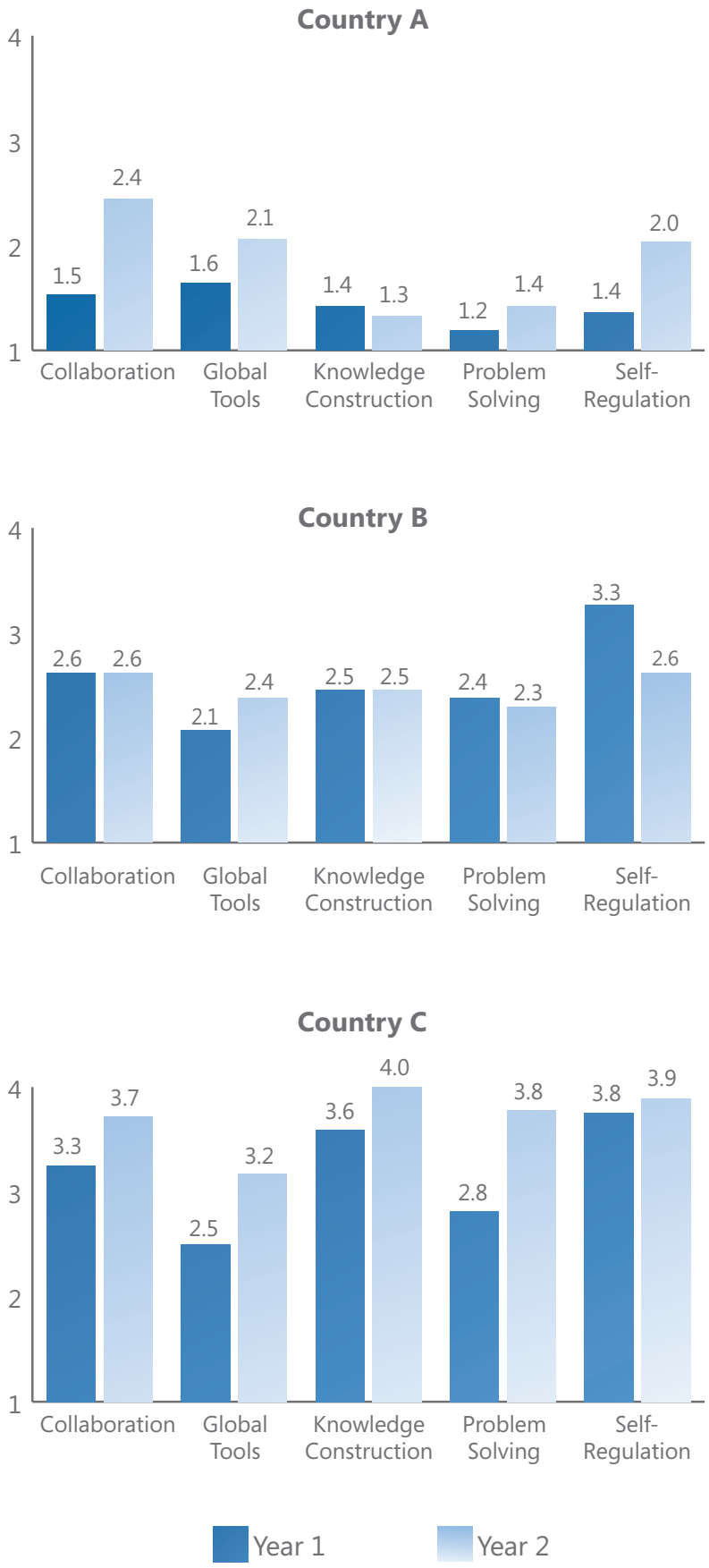
While two schools had increases in all dimensions, most schools increased in some areas and decreased in others.

Figure 11 shows humanities scores for teacher assignments in three schools in Year 1 and Year 2. As illustrated, scores and patterns of scores are different in different schools and may vary due to differences in country context and reform focus. The school in Country A started with very low scores, suggesting a very traditional teaching environment. This school focused its reform efforts in particular areas, which may explain why improvements appear to be emerging in some areas (Collaboration, Global Tools, and Self-Regulation) but not in others (Knowledge Construction and Problem-Solving).[27] In the school in Country B, scores averaged between 2 and 3, suggesting a more innovative instructional environment than at the school in Country A. In this school, slight increases occurred on some dimensions, but these changes are small and are probably due to chance rather than any systemic change in teaching practices at the school. The decrease in Self-Regulation is statistically significant, however, and may represent an area this school should focus on in years to come. In the school in Country C, scores were higher (averaging between 3 and 4), reflecting a more consistently innovative approach to teaching and learning. This school is undertaking a comprehensive and systematic overhaul of academic structures and practices, which may explain the increases in scores from Year 1 to Year 2. Nonetheless, only the change in Problem-Solving is statistically significant.

Figure 11 illustrates the diversity in year-to-year change among the pilot schools. Some are beginning their reforms within highly regimented, exam-driven systems and tend to have lower scores. Others have more freedom to undergo more comprehensive reforms, and their scores tend to be higher. Some have increased from Year 1 to Year 2, whereas others have shown little change at this point in their reform process, either because their particular reforms are not measured well with these dimensions or because their reforms have not yet reached a depth that would allow us to see significant change at the classroom level. Although these diagrams show only humanities teacher assignment scores, findings were similar in the sciences and in student work: Different countries show different patterns of results.

27 Of these changes, only Collaboration and Self-Regulation are statistically significant; the change in Global Tools scores is more likely to be due to chance.

Figure 11. Humanities Teacher Assignment Scores in Selected Countries, by Year



Discussion of Results for Change over Time

As a set, the schools in this study have taken an important first step to technology-supported innovative instruction. From Year 1 to Year 2, they have increased students' use of technology in the classroom. Furthermore, they are making progress toward more powerful uses of technology, a factor that this research has shown to be associated with the use of a broader assortment of teaching strategies. Given this relationship, we can hypothesize that the practice of teachers in the pilot schools may take on more innovative qualities over time.

Quantitative data on multiple measures, however, suggest that although the progress or setbacks of individual schools varied, no overall changes in teaching practices were in evidence between Year 1 and Year 2 of the pilot program. Several noteworthy factors affect this year-to-year comparison:

- Ten schools is a small sample for quantitative measures of instructional change; extenuating circumstances in any one school can alter the results appreciably for the sample overall. For example, researchers collected data unusually late in the year at the pilot school in Mexico because classes had been disrupted by the H1N1 (swine flu) outbreak, which likewise disrupted the implementation of reform as teachers needed to make up for lost time in covering content for end-of-year exams. As a result, the classroom observations reflected a much more traditional instructional style than may have been in place at other times during the year. Larger sample sizes are necessary to support more confident conclusions about overall change.

- Differences in goals among the reform programs may also reduce the meaningful changes that are found when data are aggregated across countries. For example, many schools are using "projects" as a framework for the instructional reforms that they are implementing. However, qualitative data reveal that different schools (and sometimes even different teachers within schools) have very different ways of conceptualizing projects. For example, projects vary in duration, the scope of the task required of students, and the extent to which they afford students the opportunity to make choices about the topic, the tools, or the strategies used to accomplish the task. Such variations make it unlikely that any common instrument would reveal consistent gains in practices related to project-based learning across schools.

- Due to the timing of data collection this analysis examined changes from Year 1 to Year 2 of the program but did not take into account any changes in instructional practice that might have been implemented during the first year. Earlier evaluation reports did not suggest that any of the schools implemented wholesale changes to instruction in the first year of the program, but some did report that they had begun to experiment with new practices, established particular new courses as test beds, or continued to build on earlier reforms that predated the Innovative Schools Program.

Despite these research challenges, it is clear from multiple data sources that most of the pilot schools have yet to achieve their vision of innovative instruction across all their classrooms. Such findings should not be surprising. The school reform literature

The school reform literature suggests that schools need at least 3 years and often longer to implement whole-school reform.

suggests that schools need at least 3 years and often longer to implement whole-school reform (Borman, 2005; Kahne, Sporte, & de la Torre, 2006; Shear et al., 2008). Whereas many of the pilot schools contain pockets of instructional innovation, these first 2 years of the program do not appear to have been sufficient for the reforms to permeate school culture and practice.

At the same time, many of the schools have made progress in particular areas of the Innovation Framework and in particular areas of instruction; even if the changes are not yet comprehensive, strong practices are in evidence in a variety of schools. The next chapter of this report profiles five of the pilot Innovative Schools, describing steps they have taken that may serve as useful models for other schools that plan to undertake comprehensive reforms.

3.4 Teaching and Learning: Lessons Learned

This chapter has demonstrated that teachers are experimenting with new practices in the classroom and that many have broadened the scope and depth of technology integration in the classroom. However, few of the schools can claim widespread adoption of innovative teaching and learning this early in the program. This experience suggests the following:

- Teachers in reforming schools are likely to adopt changes at their own pace. This implies a need for tailored supports and opportunities for peer coaching and mentoring to meet the needs of teachers at different stages of the adoption curve. It also implies a need for a commitment to continuous improvement so that momentum for change can be sustained over time.
- Some new teaching practices are easier for teachers to adopt; others require more explicit models, training, and support. For example, in this research collaboration was shown to be one of the first 21st century learning opportunities to emerge commonly across classrooms, but while teachers were beginning to experiment with new models of assessment in their classrooms most schools had not yet found workable strategies to embed it widely into instruction.
- The design of the assignments that teachers give to students strongly shapes students' learning experiences and outcomes. Curriculum design and student work analysis can be highly productive practices within learning communities for teachers.
- The widespread use of technology can be a start toward changing pedagogical practice, but technology use alone does not imply that instruction has become more innovative overall. As described by the Innovation Framework, schools need innovative visions, cultures, and supports in order to help technology to meet its potential in the classroom.

These observations suggest the critical importance for teachers of systems of support and professional development that are characterized by a focus on student learning, reflection on ways to extend and deepen new practices, and concrete models of what is possible with new approaches and tools.

4. Case Studies:
A Deeper Look at the Innovative Schools

The earlier chapters of this report have described findings across the set of pilot Innovative Schools. As we have noted, the schools vary widely not only in the context of their reforms, but also in their content. Reforms have ranged from implementation of professional development, to recreation of the curriculum, to integration of new pedagogical approaches into a more traditional program of study.

To provide a deeper look at reform in particular countries, SRI conducted case study visits to five schools. These schools were selected to represent a diverse set of contexts and reform focus areas, and are intended to illustrate noteworthy practices in the areas described by this report. The schools highlighted here include:

Bowring Community Sports College, Huyton, Knowsley, United Kingdom

Dunshaughlin Community College, County Meath, Ireland

Escuela Secundaria Técnica No. 12, Hermosillo, Sonora, Mexico

Fung Kai Innovative School, Sheung Shui, New Territories, Hong Kong

Literacy@School, York Region District School Board, Ontario, Canada

Methods for the case study visits were qualitative and adapted to fit the context of each school visited. Researchers visited each school over two to three days and interviewed a variety of stakeholders, varying the sample based on the particular people most deeply involved in reform at each school. In all schools, researchers talked to the school leader, at least four teachers, and several groups of students, and observed at least four classes. Researchers also talked to school technology directors, representatives from local education authorities, and teacher leaders or academic department chairs. Finally, researchers attended planning meetings and other events as appropriate to each context.

Bowring Community Sports College: Empowering Student Learning[28]

Bowring Community Sports College offers its 11- to 16-year-old students much more than a strong physical education program. Its real purpose is the development of thinking and learning skills and the fostering of students' motivation and self-confidence as learners. As the school has reinvented itself, rows of chairs facing the front in classrooms have been replaced with flexible open spaces, with small groups of students working around tables and teachers moving from table to table, observing and supporting learning rather than leading it. Teachers design cross-disciplinary learning activities and combine or divide groups of students for learning activities depending on their learning needs. This case study highlights the major changes triggered by Bowring's focus on students' learning and engagement and the way in which a culture of self-evaluation and striving for improvement has permeated the activities of students and staff.

Introduction

Bowring Community Sports College is a specialist school located outside the city of Liverpool. The majority of students at the school are from low-income backgrounds, and roughly half are designated as requiring special education. In the past, both attendance and student performance were major problems at this school. Today, the school staff has turned the situation around by putting student needs and interests first. In the grade levels participating in the reform, attendance, behavior, and academic engagement have all improved.

Bowring began its involvement with the Innovative Schools Program with a clear vision of where it wanted to go and with experience piloting some of its target innovations with Year 7 students (11- and 12-year-olds). During 2007-08, the school instituted a skills-based curriculum for Years 7 and 8, replacing standard subject-specific classes with longer learning periods with names like Discovery Time and Challenge Time. Since then, this approach has expanded to an additional grade level each year and has started spreading to the core subject areas of mathematics, language arts, and science.

Bowring has the explicit goal of instilling 21st century skills as well as the content standards of the UK's national curriculum. As the school's deputy head said, the school intends to be "fluid, flexible, and fun." Bowring executes flexible scheduling and student grouping based on student learning needs. On a given day as few as six

28 After the 2008-09 school year, Bowring Community Sports College was combined with another school to create the Huyton Arts and Sports Centre for Learning.

students meet with two instructors to work on the unusual combination of French and trampoline skills, and more than 100 students spend an entire morning in a large auditorium working in teams to design, budget for, and create costumes that they then model for their classmates in a high-energy fashion show.

Organizing School around Student Learning

Bowring's transformation began with a commitment to rethinking everything about the school so as to better serve learners. This has meant not only articulating learning goals and changing pedagogy, but also changing the way time is used, the spaces where learning occurs, and the way staff are assigned and work together. Bowring's lead teacher explained the primary criterion for deciding whether or not to do something: "It has to have a significant impact on student learning. If it doesn't, forget it."

Central to this effort was the development of a common vision of a set of key transferable skills that students will need for the 21st century. Staff members have worked to define a set of Personal Learning and Thinking Skills (PLTs) needed to become a Reflective Learner, Teamworker, Effective Participator, Self-Manager, Independent Enquirer, and Creative Thinker. Both teachers and students share this skills vocabulary and understand that learning activities are intended to support students' development in these areas.

Spreading the innovation has been an incremental process. Reform activities were tried first by willing teachers outside the core content areas emphasized in national examinations. Mathematics, language arts, and science teachers who were concerned about the effect that the new approach might have on test scores thus were given the chance to wait and see. The new kinds of learning activities were instituted first with a single grade level and then expanded to additional grade levels as the first cohort of students moved through the school.

This strategy appears to be working. Teachers in grade levels and subject areas not participating in the reform have become curious and have sought to learn more. By 2008-09, core subject area teachers had begun team teaching with those who had been doing project-based learning.

The innovation is being spread further by Bowring's local authority, which is engaged in consolidating and moving schools into new facilities under the government's Building Schools for the Future Program. Bowring was merged with a neighboring school after the 2008-09 school year to form the Huyton Arts and Sports Centre for Learning. Bowring's approach to teaching and learning was selected as the model not only for the new consolidated school but also for the other learning centers being created by the district.

Bowring has also had influence beyond its district and the UK through participation in international Innovative Schools Program activities and its selection by Microsoft as the subject of a set of in-depth video case studies.

Teachers are responsible for developing learning activities that will give students the opportunity both to develop personal learning and thinking skills and to meet UK content standards. Learning activities are designed to put students in an active role, with teachers facilitating their learning rather than transmitting knowledge. The students have become comfortable with the PLT vocabulary, and it is common to hear them talking about their skills as Reflective Learners and their ability to give feedback.

Project-Based Learning

Essential features of project-based learning include a real-world connection with a "hook" to capture student interest and a motivating goal for the activity, the use of small groups or teams in which students have differentiated roles, the involvement of the multiple disciplines relevant to attaining the activity's goals, and the incorporation of self-assessment, with students reflecting on their progress and what they need to do going forward. Bowring instruction exemplifies all these elements.

Many learning activities open with drama—the arrival of an "alien" on campus, exploding water, or the opportunity to launch a rocket—to capture students' attention. Projects appeal to students' interests by giving them choices in the specifics of project goals, drawing on their out-of-school passions, and providing opportunities for them to demonstrate their work to authentic audiences. Students

Learning and subject matter skills are taught together as part of Discovery Time. Students work on projects designed to teach Personal Learning and Thinking skills related to collaboration (Respond to Feedback in a Positive Way, Invite Praise, Adjust Work in Response to Feedback, and Give Others Advice on their work) as well as to convey important nutrition concepts. Eleven- and 12-year-olds work in groups of three to five on nutrition research topics that they themselves generated during a brainstorming session.

Selected topics range from reporting on what Bowring students eat for breakfast to designing a food plan for a football player to the dangers of under- and over-eating.

Student groups are heterogeneous in terms of ability, including both academically talented students and students with learning or behavioral disabilities. Each group has a student leader who is responsible for assigning roles and making sure that every student contributes.

The teacher has purposely given the students more work to accomplish during the instructional period than they can reasonably be expected to finish in order to prompt them to think about how to work more efficiently. Part of each group's assignment is doing a self-assessment on their collaboration skills. The teacher closes the session with a class discussion of what they need to do better the next time they have a group project.

work in pairs or small groups, with each student having a distinct role. There is a great emphasis on having students think about their own thinking. Each group of students participating in the fashion show activity, for example, assessed their performance as Creative Thinkers at the conclusion of the show.

Care is taken to connect different learning activities to each other in a way that reflects the real world rather than conventional divisions into academic disciplines or 50-minute class periods. Building on the fashion show activity, for example, students will practice language arts skills by writing newspaper articles describing the show. As Bowring staff members have become more adept at designing projects, they now carry themes across multiple projects to create "projects within projects" that cut across many different disciplines and extend over multiple weeks.

As students experience this kind of instruction, they come to expect to be in charge of their own learning. A science teacher new to the school described the assistance that she received from her students as she tried out project-based learning: "The kids knew their roles better than I did last year."

Dunshaughlin Community College: Teacher-Focused Reform in a Strict Standards-Based Environment

On the premise that reform begins with the teacher, Dunshaughlin Community College (DCC) has focused on the professional development of teachers, helping them to strengthen their skills and build an active learning community. DCC has developed a strong relationship with St. Patrick's College, which has served as a catalyst for the professional development program at the school. The dynamic professional development environment at DCC includes structured workshops, the implementation of new technologies to facilitate teacher collaboration, and a strong network of school leaders and support staff members who are responsive to teacher needs. The growing learning community at DCC extends beyond the school to include teachers from throughout the district, making it possible for teachers to learn from experiences of colleagues at other schools. This focus on professional development enables reform within a rigid national education system, within which curriculum-based reforms are not always feasible.

Introduction

Dunshaughlin Community College (DCC) is a secondary school in the small community of Dunshaughlin, Ireland. Since the advent of the Innovative Schools Program in 2007, the school has been working in partnership with St. Patrick's College, Dublin's premier teacher education institute, to introduce instructional reforms at the school. A geography teacher noted that "[The program] has offered a pride and a positive vision to work towards. Students are also happy to be part of it. They buy in to it very well. The self-esteem of the school has [been] raised."

At DCC, educators share the belief that reform begins with the teacher. Building from this premise, the school has focused reform efforts on teacher professional development and building a strong learning community. Teachers at DCC have the opportunity to participate in a variety of professional development activities and the flexibility to do so voluntarily and at their own pace. One interviewee explained

> [We] believe that professional development should be influenced by teachers' needs and experience and be very classroom based. They should be able to reflect on their process as well.

The approach of focusing reform on teacher professional development and community is enabling changes to occur, even within a rigid education system. DCC operates within a traditional national education system with strict national

curriculum standards. This context can be prohibitive of sweeping curricular reforms. By focusing on professional development, DCC has found a way to support teachers in improving their practice and supporting student learning within the traditional education system in which they operate.

The professional development at DCC has focused on 21st century teaching and learning and the integration of relevant technologies into teaching. Previous professional development was largely "technocentric"—that is, it focused on introducing technology as a supplement to what teachers were already doing in the classroom rather than on changing pedagogical practices themselves. The new professional development program emphasizes pedagogy first, focusing on 21st century teaching and learning practices and looking at ways that technology can support innovative practice. Although all teachers have the opportunity to refine their practice to support students in developing important 21st century skills, the most dramatic changes to teaching practice have occurred primarily in "transition year" classes, where teachers are not bound by the exam structure and have more flexibility to experiment with innovative approaches.

Professional Development

Dunshaughlin's vision is to empower teachers to institute their own reforms in their classrooms while working within the system of national testing standards. To that end, professional development is the primary vehicle for reform at DCC. The professional development at DCC offers teachers a modular program anchored in classroom practice, where teachers can select different modules that meet their own professional needs. Through workshops and classes, teachers learn innovative instructional strategies and how to use 21st century technologies in the classroom. Professional development also gives teachers access to social networks through which they can learn new practices, share experiences, and find solutions to the real challenges that they face in the classroom.

St. Patrick's College designed the Accredited Model for Professional Development for DCC, which the school made available to all staff. This enhancement to the existing professional development program made it possible for teachers to earn university credits for their course work. The program enables all teachers to add to their credentials; those who choose to do so can also pursue a postgraduate certificate or diploma, building toward a Masters Degree in Education.

Unlike the professional development provided by the state, which is often held in distant locations and can be disconnected from teachers' day-to-day needs, the current professional development program is onsite, designed to be responsive to teachers' needs and experiences. The content of workshops, classes, presentations, and other forms of professional development is informed by what teachers say they need as well as by the expertise of professionals from St. Patrick's College. School leaders and support staff collect input from teachers in two specific ways: first during a series of meetings to which all staff are invited and second through an annual process in which teachers specify their needs and other issues they want school leadership to discuss.

One of the key components of the professional development initiatives at DCC is that teachers have access to both technical and professional support personnel. The support personnel associated with the St. Patrick's College courses communicate frequently with the teachers and visit the school at least once a month. In addition, teachers work closely with the district's Staff Support Officer, who serves as both technology expert and technology support person for schools in the district. The Staff Support Officer leads workshops and classes, answers teachers' questions and addresses concerns (usually within 24 hours), and finds other professionals to come to the school to give workshops on pedagogical approaches or technological tools.

Over the past 2 years, specific workshops offered to teachers have included exploring digital imagery and digital video for learning, web 2.0 tools for teaching and learning, using OneNote for teaching and learning, and using the Teacher Assignment/Student Work (TASW) Framework to explore 21st century learning principles. St. Patrick's College provided the first three workshops in direct response to teacher requests for guidance with innovative ways to integrate technology into teaching and learning. The fourth module, according to the university faculty involved with the postgraduate accredited program, was designed to "facilitate the teachers to develop a greater awareness of the principles of 21st century learning and introduce them to the meta-language used to describe such learning environments." The TASW workshops garnered unanimous praise from participating teachers and from the school leader at DCC. The school leader explained that the TASW workshop provided a universal approach, applicable to all subject areas, for "what a 21st century learning assignment should look like." She continued,

> That got people thinking an awful lot. … It excited people to start to think about where they should be aiming to go… We're so conditioned to think of assignments as worksheets, as essay questions and so on. But, to get people to think about [the fact that] assignments could be project based learning…to open people's minds. … Now [teachers] know what they could potentially be doing, it's changing their thought pattern. … It's about changing what we've been conditioned to think about as what education is.

Some teachers at Dunshaughlin pursue classroom-based research projects as one path to professional development. One teacher's project analyzed technology use at the school. The teacher set out to determine the extent to which teachers and students at DCC use technology for teaching and learning and whether or not there were any benefits to technology use. To conduct her research project, the teacher learned the quantitative data analysis software SPSS and recruited a student to work with her as a research assistant. Over time, the project grew and was incorporated into a larger survey of approximately 1,000 students, including all DCC students as well as students from other schools. The results were used as part of the evaluation of the reform at Dunshaughlin.

At DCC, educators see collaboration as an outcome of the concerted focus on developing teacher capacity and integrating technology into teaching and learning. In many cases, shared professional development activities inspire collaboration because teachers are engaged in joint work and experiences that catalyze further communication and collaboration. In addition, increased access to technology supports collaboration by making it possible for teachers to share resources and communicate even when they are not together in person. Although the school has not introduced formal structures to facilitate collaboration and time constraints are widely cited as a barrier to further collaboration, teachers still report that they share often share ideas and resources with one another informally.

District-wide Learning Community

Educators at DCC frequently speak of the need to build reform from the bottom up. District and school leaders alike have confidence that teachers themselves can be the drivers of reform if given the right support, access to the right 21st century technologies, and insight into research-based teaching practices. The learning community at DCC and throughout the district plays an important role in realizing this vision.

At the school level, teachers form learning communities primarily within their subject departments. Each department has its own web page on the school's Microsoft SharePoint site, where teachers share resources and useful links with each other and with their students. The departments have eight formally scheduled meetings per year, but they also meet informally "all the time," according to the school leader. Beyond their departments, teachers, school leaders, and support staff communicate informally and in meetings about ongoing teacher needs. Experts from St. Patrick's College and the Microsoft staff work not just with school leaders, but also directly with the district Staff Support Officer and teachers.

Social networks extend beyond the school to other schools and to the district administration. New technologies and approaches, such as 1-to-1 computing and wireless access in the classroom, are first piloted in individual schools. The results of the pilot are then shared throughout the district and inform future changes across the schools. The district is unique in that it has also built a learning community of school administrators. Principals from all schools participate in frequent meetings, and there are layers of SharePoint access for principals, teachers, administrators, students, and parents, all of whom become participants in different respects when new things are introduced to a school. One district official, commenting on the distributed approach to reform, said:

> It's not us telling [teachers] what to do all the time, but we are a community of learners…and with that shared experience everybody has relevant experience and contributions to make. Everybody recognizes that best practices in every school are well worth sharing, so we go into some detail into those.

The building of district-level learning community enables school reform at DCC. Reforms at DCC are strongly linked to efforts undertaken at the other nine schools within the district. For example, one school piloted a 1-to-1 computing program. Before deciding on what computers and software to use, school leaders met with every teacher to discuss his or her needs. The Staff Support Officer summarized the results and met with teachers in groups to facilitate their learning about particular technologies. To ensure students and parents had a sense of ownership of and accountability toward the program, students were expected to teach their parents about computers, beginning by requiring all parents to establish an e-mail account so their children could teach them how to use it. On the basis of what the district learned at this school, it began planning implementation of the 1-to-1 computing program for targeted groups of students at DCC.

Technology as a Tool

The school and district see technology as an important tool both for the professional learning community that has been established and for classroom teaching and learning in all subject areas. The technologies that teachers and school leaders at DCC use the most are SharePoint and the school's web portal. According to interviewees, educators at DCC use these technologies to facilitate teacher professional development, the sharing of resources, and communications among teachers, students, parents, and administrators. In particular, teachers across the board cited SharePoint as a particularly valuable and widely used resource for sharing lesson plans and resources within the learning community. The Staff Support Officer for the district uses SharePoint to facilitate her responsibility for advising and providing workshops in IT at the nine secondary schools in the district. For example, she has developed dedicated SharePoint sites for the staff at each school in the district, with videos and other resources designed to meet the needs of those particular staff members.

Teachers are also using technology in new ways in the classroom. One music teacher, for example, loads audio files to the SharePoint site for students to download to their MP3 players so that they can gain extra listening practice at home. Even in subjects such as woodworking, students use laptops and have access to a simple CAD program for drawing plans. As one school leader said, "We have used technology as a catalyst to get teachers to rethink what they do," and it appears to be working for teachers. One teacher said, "Up until now, I was using IT, but I used it from the top of the room. [In the computer room, students are] quite willing to work by themselves. I find that I'm handing over a little bit more of the control to them.... They're getting more independent."

Changes to Teaching and Learning

Under the national curriculum standards it is very difficult for teachers at some levels to incorporate project work into their teaching, in part because the final exam structure is primarily an individual written examination. Although the standards limit lesson plans and classroom practices for most grades, students at DCC can opt for what is called a Transition Year in between their junior cycle (the first 3 years of secondary school) and their senior cycle (the last 2 years). The Transition Year (TY) has no assessment requirements, which gives teachers and students more flexibility to engage in innovative teaching and learning practices such as project-based learning and the use of technology tools. One teacher said, "Curriculum directs at least 80 percent of instruction… It's tied to the exam. That's why the transition year is so good, because [students] can learn anything and any way they like." Many TY teachers have their students do longer term projects within their subject areas. Students use a wide range of technologies, such as digital cameras, audio and video-recording equipment, computers, and various kinds of software. Their projects result in products like poetry anthologies, radio shows, photo stories, and other vivid representations of what the students have found and learned.

One teacher recounted the range of skills her students demonstrated in one project in which they created a film that won a film festival in Cork. The students wrote short stories, which they then they discussed with one another. They voted on which one would be suitable for a script. After adapting the story, they produced it as a film and burned their own DVDs.

There has been a notable shift toward the inclusion of project-based learning in fifth-year classes, particularly among the language teachers. Notably, rather than using project work as an add-on to the traditional exam-focused curriculum, the French, German, and Irish teachers are using project work as part of the preparation for the oral Leaving Certificate exam. Projects undertaken in these exam classes are typically based on broad topics that are explicitly related to the state exams. For example, during the oral language exams students must be able to converse about a range of topics that are specified in the course syllabus. Teachers design projects around those specific topics.

Some language students spoke at length about how much more they felt they were learning with the use of projects and technology. They discussed the PhotoStory projects they did on German rock bands:

> In normal German [class] it's all grammar work and sentences. [The project] was a nice break from that. It improved my spoken German. You made the script yourself. I have never written a script myself in German. You are able to do it more the way you want it.

Challenges and Opportunities

As discussed in this report, Ireland's national exam structure is one of the greatest challenges to reform. The exam system is backed by traditional institutions that are centrally driven and can be slow to respond to developments in technology and learning science research. DCC has faced this challenge not by trying to change the system but by facilitating local reforms that empower teachers and give them greater access to ideas, technology, and professional development.

Other important challenges to changes in teaching and learning are constraints on time and financial resources. One teacher said that despite the difficulty of finding enough time for planning, she tries to make her classes more interesting and exciting for her students. She also said she tries to identify what kinds of learners they are, so she can adapt her lessons to their needs. It can be complicated to make such changes, so she discusses them with her colleagues and has found some answers in the workshops offered through the Innovative Schools Program.

School reform at DCC continues in spite of the challenges it faces. DCC's teachers are enthusiastic about the support they receive and the opportunities to create more interesting learning opportunities for their students. As one interviewee said, "It's a traditional school in a traditional system. If you can make changes here you can make changes anywhere."

Escuela Secundaria Técnica Estatal No. 12: Introducing Technology-Supported Projects Across the Curriculum

Escuela Secundaria Técnica Estatal No. 12 in Hermosillo, Mexico, has embarked on a whole-school reform effort focused on the use of projects and the integration of technology in teaching and learning. The expansion of reform has been rapid despite challenges posed by Mexico's relatively traditional educational system. Teachers credit the school leader with communicating her vision clearly and actively working to support teachers and learners at the school. In classrooms, students spend time on school-wide projects in addition to their everyday subject matter learning. Every 2 months, students present their projects—which span multiple subject areas—to a gathering of students, teachers, and parents. This case study highlights the ongoing efforts at Escuela Sec. Tec. No. 12, which provide lessons for school leaders implementing reform in resource-constrained education systems.

Introduction

Escuela Secundaria Técnica Estatal No. 12 was established in the mid-1990s in Hermosillo, Sonora, Mexico. The school has grown significantly since its inception and now serves close to one thousand 12- to 15-year-old students in morning and afternoon shifts. At Escuela Sec. Tec. No. 12, the Innovative Schools Program focuses primarily on integrating thematic projects across the curriculum and expanding the use of technology in the classroom. As a leading innovator in the region, the school has been selected to pilot national changes to basic education and develop indicators of success for project-based learning. Through its participation in the Innovative Schools Program, the school has also updated its infrastructure, which now includes an English language lab, several computer laboratories, LCD projectors, and electronic whiteboards. Teachers have also received several technology-related trainings through a partnership with Monterrey Tech, a prominent Mexican university.

Changes at Escuela Sec. Tec. No. 12 are proceeding despite a traditionally rigid educational system. Although education is decentralized nationally, the Sonoran state government dictates what content needs to be covered and at what pace. The rigidity of state standards and a longstanding tradition of teacher-centered instruction create challenges for innovation, but the school leader has worked hard

to meet these challenges head on. The school has been helped by changes to the country's national educational vision, which aligns well with the school's reform efforts. Additionally, the state government has been supportive of the school's reform work, seeing it as a potential model for other schools.

A Trend-Setting School Leader

Teachers and students alike attribute much of the innovation at Escuela Sec. Tec. No. 12 to its dynamic and visionary school leader. The school leader's vision focuses on three core aspects: (1) being innovative by applying projects and technology use to classroom practice, (2) being inclusive by integrating students with special needs into the school, and (3) being environmentally responsible by pursuing active policies to reduce waste and promote environmentalism.

At Escuela Sec. Tec. No. 12, communication with teachers is a priority. New teachers receive CD-ROMs with the school mission and vision statements, documents related to the school reform, and subject-specific materials related to state standards. At regular staff meetings, the school leader gives staff opportunities to discuss broader objectives and goals. What is not discussed as a group is covered during the school leader's individual meetings with teachers. Describing her philosophy, the school leader says, "It's important to share everything you are thinking of doing with the teachers, as well as with the broader community."

The school leader's efforts to promote teacher buy-in have helped sustain reform progress in spite of teacher turnover: new hires and teacher transfers are out of the school's control, and more than 20 new staff members arrived in the school in 2009. Nevertheless, in a little over 2 years, the school has expanded project-based learning from 17 groups of students to 29, due to rapid adoption of the project in the afternoon shift. "We can't eliminate the problems associated with teacher turnover, but having a strong community helps reduce them," says the school leader. "In this school, if several science teachers leave, the others help bring the new hires up to speed." Interviewed teachers agreed that their learning community was "particularly strong and different from other schools in the region."

At Escuela Sec. Tec. No. 12, one of the school's core missions is to promote environmental awareness. To this end, several of the new school-wide projects have been focused on the environment, biodiversity, and conservation. The school also participates in Environment Online (ENO), a Finnish-led virtual network designed to promote sustainable development. As part of their involvement, students work on short projects (e.g., The Autumn Equinox) in collaboration with other schools around the world. Students also manage an onsite recycling center and visit other schools to promote recycling and conservation.

Creating Connections with the Community

A core aim of the innovative work at Escuela Sec. Tec. No. 12 is to create connections to the broader community—with parents, schools, the state government, and businesses. Although community-building efforts are still in early stages, the school has already made significant strides. Project presentations actively involve parents and in some cases outside community members. One student group, for example, presented a radio program to listeners on air.

Cooperation also extends beyond the realm of the school projects. In the region, the school has built ties with the deaf community, integrating students with hearing disabilities into regular lessons and hiring a part-time support team to train teachers and students in sign language. In addition, the school is currently in negotiations to be "adopted" by a local business, an agreement that would help the school update its physical infrastructure and sports fields. For schools in resource-constrained education systems, developing partnerships with local organizations can be extremely beneficial.

Integrating Projects into the Curriculum

School-wide projects have been the primary focus of the reform efforts at Escuela Sec. Tec. No. 12. Every 2 months, teachers collectively select a project theme that meshes well with content and competency requirements for that period. Once the school-wide project topic is selected, teachers meet in "academies" by grade to plan their lessons. In doing so, they identify opportunities for cross-disciplinary collaboration, while ensuring that they cover required material for both the project and their subject area.

Once the project period begins, teachers integrate the chosen theme into their lessons in a variety of ways. In some classes, students spend some time throughout the 2 months working on their projects, and in others teachers use more traditional methods for most of their instruction and use the project theme as the basis of final assignments for their units. Teachers and students agree that the project themes such as "Mexican adolescence" and "our cultural diversity" have been relevant and interesting to the students. By incorporating linkages across disciplines, projects allow students to see the interconnectedness of subject areas and their applications to real-world problems.

The use of technology is required during project presentations. Students often use technology to conduct their projects, and in many cases they use PowerPoint and video to present their results. To reach the current level of ICT integration, the school took two concrete steps to support teachers and students. First, new technology was introduced, including multimedia projectors and additional computer labs. Second, teachers received several rounds of ICT trainings from Monterrey Tech, a partner university on the Innovative Schools project. Students appreciate the opportunity to use ICT in the classroom. "It's great to use computers for our learning," said one student. "It makes things much more interesting."

Students are conducting school-wide presentations about their work from various classes on the influenza virus—the school's current theme. Over the past 2 months, students have charted the spread of the H1N1 virus in math, learned about the virus's pathology in science, translated flu prevention pamphlets they made in Spanish class into English, and used publishing software to produce public health posters in visual arts class. Now, their teachers, peers, and parents will gather to hear the students present their projects, using a method of students' choice. "There was a lot of work involved, but we learn better [using the project-based learning method]," said a student. Not only have project presentations been popular among students, but they have also increased parent involvement at the school. Since the project presentations began, greater numbers of parents have attended each year, actively showing interest in their children's learning.

Challenges and Opportunities

Although Escuela Sec. Tec. No. 12 has made important progress on providing new learning opportunities for students, Mexico's educational past still poses obstacles to reform. Traditionally, many teachers have not been well equipped to meet the challenges of 21st-century teaching and learning. For example, staff members have done their part to acquire basic ICT skills, but more professional development is needed to help move their assignments beyond basic classroom uses of technology, such as development of PowerPoint presentations, to higher level ICT integration that is more powerful in promoting 21st century skills for students. Moreover, some teachers have been slower than others to make changes to their pedagogy, so traditional instruction persists despite the increase in thematic work for students. In this respect, the school needs more time for the vision of reform to trickle down to the classroom. Teachers add that deepening their ICT use will require more consistent planning time.

There is still more work to be done, but in the next few years, the school leader hopes to make dissemination of Escuela Sec. Tec. No. 12's reform experience a top priority. "We need to do a better job sharing our vision with other people, our superiors, and other schools," she said. If standardized tests provide any indication, the school certainly has a lot to pass on: Using third-year students as a base for comparison, Escuela Sec. Tec. No . 12 scored higher than more than 90 percent of Mexican schools on the most recent national exam—across subjects, an average jump of 7 percentage points over the past 2 years. Although it is difficult to attribute this increase to any specific elements of reform, it is an indication that Escuela Sec. Tec. No. 12 is moving in a direction that is good for students.

Fung Kai Innovative School: Transforming the Curriculum through New Technologies

At Fung Kai Innovative School in Hong Kong, 8-year-old students are actively learning about parallel lines. In response to the shapes that the mathematics teacher poses as examples, students come to the front of the class and use drawing tools on the electronic whiteboard to explain why they think that lines are or are not parallel and then use their "e-books" (electronic textbooks accessed through each student's netbook computer) to read, watch, and listen to related content. This type of classroom environment is increasingly commonplace at Fung Kai, thanks to new tools and an intensive and collaborative teacher activity to rewrite the curriculum. This case study describes Fung Kai Innovative School as an example of focused school-wide teacher collaboration and the rapid, and rapidly evolving, adoption of new technologies to support new models of teaching and learning.

Introduction

Fung Kai Innovative School is a primary school in the New Territories of Hong Kong serving a mixed population of students from the local area and from across the border in China. The Innovative Schools Program at Fung Kai focuses on a schoolwide project to rewrite the curriculum to be more engaging and relevant to students and to take advantage of newly available technologies. Starting in the 2007-08 school year the "e-schoolbag" project provided students with individual netbook computers, and in November 2008 the school moved to a newly designed, spacious building that offers high-speed connectivity throughout the school and an electronic whiteboard in every classroom, among other high-tech capacities. In its first 2 years the project has focused mainly on Grades 2 and 3 (students approximately 7 and 8 years old) and the subjects of English and mathematics, and the school plans to add new subjects and grade levels each year.

Teacher Collaboration

Effective teacher collaboration is not an end in itself, but a means to develop teachers' professional capacities and accomplish improvements in teaching and learning. At Fung Kai Innovative School, collaboration is driven by a goal that is well defined, practical, and shared: the development of new curriculum that teachers will use in their classrooms in the hopes of improving student engagement and outcomes. Teachers work together within subjects and grades. For example, the three third-grade mathematics teachers have time each week to work together to

develop a new math curriculum for that year. The curriculum redesign is staged, and teachers of the grades and subjects that are the current focus of the redesign are given reduced teaching loads to allow up to 8 working hours each week for collaboration.

The curriculum development process operates within a school culture that promotes collaboration and widespread participation in reform. The vision of whole-school technology-enhanced reform is strongly held by school leaders and consistently communicated to all teachers. Time for focused collaboration of teacher teams that are rewriting curriculum this year is enabled by workload shifting, so that teachers who do not have development responsibilities this year support those who do. Said one teacher of the collaborative culture at Fung Kai and how it enables reform, "This is not an individual task - we always share, formally, informally. We are facing a big challenge together, not just on our own… We really have one another. We have the heart to do it."

Other supports for collaborative lesson planning include human resources at several levels: a team leader for each subject area/grade level team, two curriculum coordinators at the school who guide the process and resolve difficulties that teachers are facing, and consultants from the government's curriculum development office who participate in occasional meetings to help them work through the development process. In each subject area, there is also a strong enabling partnership with a publisher whose job it is to create electronic materials from the lesson plans that teachers develop. This relationship makes development of technology-supported curriculum affordable for the school and allows the teachers to focus on teaching and learning rather than technology design.

The process of collaborative curriculum development at Fung Kai begins with brainstorming students' likely difficulties on a given topic. For example, when mathematics teachers planned the activities that their 8-year-old students would do to learn about liters and milliliters, they used their prior experience teaching this topic to decide that students would probably have trouble reading the measurement scale or changing scales from liters to milliliters. They discussed relevant student prior knowledge (they know there are different types of instruments but do not understand the concept of standard measurements), illustrations that would make the ideas come alive (How many students can drink a cup of water from a 1-liter jug? It depends on the size of the cup!), ways to make real-world connections (students could bring in pictures of liters and milliliters that they found in real life), and opportunities for engaging technology-supported games. As they talked, teachers looked at existing materials and Internet-based resources that they could build on as they develop their own curriculum.

As planning continues, the teachers will create lesson designs and work with their publishing partner to turn them into a section of an electronic textbook, creating supplemental materials for offline activities as appropriate. When the unit is ready all three teachers will use it with their students and then get together to reflect on the process and discuss lessons learned, both for ongoing curriculum development efforts and to pass on to next year's teachers of this subject.

Rapid Adoption of New Technologies

While the staged curriculum development process is creating electronic materials for use in particular classes, the availability of electronic whiteboards and other technology in every classroom is driving schoolwide integration of ICT into teaching and learning. Shortly after the move to the new building, electronic whiteboards were introduced with training in their use from the vendor. This generic training was followed by collaborative processes to support integration and shared understanding: As requested by one of the school's curriculum coordinators, each teacher devised two lessons that made use of the electronic whiteboard and then reported back to the group to share lessons learned and to think together about how best to use this new tool in the classroom. This process of building comfort and skills with the new technologies is essential, said the coordinator: "Readiness of the teachers is more important than the equipment." Technology use is also supported by school leaders, who meet with teachers every Wednesday to listen and help resolve any challenges the teachers are facing.

In the e-schoolbag classes, in addition to learning to use the electronic whiteboard teachers and students are becoming accustomed to netbook computers and learning through electronic textbooks, or e-books, rather than traditional textbooks. Rapid adoption of these computers by young children (7 and 8 years of age) is driven by their enthusiasm. Teachers say that the task of adoption is promoting students' independent problem-solving skills: if they run into technical difficulties, they have to figure out how to continue to participate in the lesson. "It's real-time kind of training," said a teacher.

In a third-grade English class, students of approximately age 8 have been studying vocabulary about the names and tastes of foods. After a whole-class review of what they have learned so far, students read stories using these vocabulary words in their e-books. Students wear headphones so they can listen to the words pronounced correctly aloud as they read.

The teacher then asks for volunteers to play a game on the electronic whiteboard. All hands go up, and five students are selected. In the game, students match the name of a food with its taste, practicing both vocabulary and grammatical rules about singular and plural (**Soy sauce tastes** salty. **Cookies taste** sweet.) If a student puts a word in the wrong category, the class helps him or her figure out where it should go and then gives the school congratulations cheer in English (Clap, clap, clap-clap-clap, Good job!).

As a final application of what they have learned, the teacher asks students to use the chat room function in the Microsoft SharePoint software to write sentences about the foods they like and how they taste. Students' contributions are all projected on the electronic whiteboard, and the teacher selects particular sentences to discuss as the class continues working.

Changes to Teaching and Learning

Learning is active. One of the most visible changes to teaching and learning is that students are actively engaged in learning activities. The redesigned curriculum provides a variety of ways for students to interact with content: They come to the front of the room to do activities on the electronic whiteboard, watch or listen to content in their e-books, or solve problems in pairs or small groups. While traditional teaching methods only allow a small number of students to respond to teachers' whole-class questions at a time, teachers can now display responses submitted by all members of the class and discuss them as a group, so a larger proportion of students are engaged in the learning.

Teachers report that student engagement and enthusiasm for learning have risen sharply. According to one mathematics teacher, "[students] are eager to learn more. Students will prepare their lesson and study the next chapter even though I do not ask them to do the preparation work. They do it by themselves."

Technology helps make concepts visible. E-books provide dynamic illustrations of concepts for students, and tools on the electronic whiteboard can be used to help teachers demonstrate concepts or procedures. These tools can equally be used by students to illustrate their own ideas, such as alternative ways of demonstrating that two lines are parallel.

Students work together to build knowledge. While it is relatively common for students to collaborate in pairs or small groups to complete a particular task, classes at Fung Kai Innovative School also illustrate group reflection and knowledge building as a class. Electronic polling and chat tools collect and display ideas from all students for group discussion, making visible the learning of the class as a whole. In addition, the two classes profiled on this page and the next illustrate the collaborative culture in which students support each other and build on each other's ideas to solve problems or complete tasks.

In a third-grade mathematics class, the 8-year-old students are learning about parallel lines. The class begins with the teacher soliciting prior knowledge about the definition of "parallel." Students get out their netbooks to take a pre-test that asks them whether several given sets of lines are parallel. The quiz results are automatically tallied and displayed on the electronic whiteboard so that all participants can see students' current levels of understanding.

The objectives of today's class are to learn to identify parallel lines. The teacher asks group leaders to watch a brief segment in their e-books, including animation to show the dynamics of measuring and comparing distances. The teacher then asks a group leader to explain how to measure the distance between two lines, while the teacher demonstrates with a pair of lines projected on the whiteboard. Students work in pairs to try another example on their worksheet.

As the class proceeds, the examples get trickier. Are lines of different length still parallel? What about two lines that are displaced so they don't overlap? Examples are projected on the electronic whiteboard, and students come up to explain their measurement strategies. One student uses an electronic ruler tool on the whiteboard; another uses his finger to drag the lines into more convenient proximity. Students work in pairs again, solving more difficult examples.

At the end of class, the teacher summarizes the rules they have discovered. Students retake the quiz, and this time the projected results show they all got the last question correct. The teacher congratulates them on their progress.

Challenges and Opportunities

The goal for curriculum reform at Fung Kai Innovative School is to transform students' learning experiences, and newly available technology tools have been a key driver of the change. School leaders acknowledge that the vision for technology integration came before the vision for how it will transform teaching and learning. Indeed, while classes are becoming increasingly interactive and collaborative, they retain many aspects of traditional teaching: For example, teachers manage learning in discrete units of activity as they always have. Teachers and reform leaders report that in the first year of the reform their primary focus was on learning and using the new technologies, but as the reform progresses they are increasingly looking beyond the technology to consider more explicitly how it can enable more powerful transformation of pedagogy.

As the reform continues at Fung Kai Innovative School, both the widespread use of technology and the pedagogies it enables are continuing to evolve. Students and teachers alike are enthusiastic about the positive changes that have been made so far, which in turn serve to illustrate the potential that still can be achieved. According to teachers, watching the results in the faces of the children makes the effort worthwhile: "As a teacher, if you find that the students make progress you're so happy… We do this for the children, not for the teachers. That's important."

Literacy@School Program: Building a Culture of Learning through Professional Development and Shared Leadership

The Literacy@School (L@S) program in Ontario, Canada, builds teacher capacity through professional learning communities that articulate teaching practices as a means of promoting reflection and discussion. In this unique model for professional development and collaboration, a selected cohort of teachers serve as authentic examples of desirable instructional practices that are observed in real time. Over the 3 years of its existence, L@S has demonstrated itself to be a powerful mechanism for school reform. Acting as cross-pollinators, teachers serve as a conduit for learning within and across schools as they create "soft-walled" classrooms and offer their teaching for observation by other teachers and even school leaders. According to the Board Superintendent, L@S shows the "how" of the possibilities in literacy instruction. It makes learning—instruction, intentions, and decision-making—visible and shared.

Introduction

The Literacy@School program (L@S) is one of several elements of the Literacy Collaborative, the comprehensive literacy plan of the York Region District School Board (Board) in Ontario, Canada. According to the Board's website, "The goal of the Literacy Collaborative is to increase student achievement by using assessment data for the selection of resources; building teacher and administrator capacity in literacy instruction for all learners; and establishing sustainable, collaborative professional learning communities within and among schools in the district."

L@S focuses on the latter goals of building teacher capacity in literacy instruction and establishing professional learning communities at the teacher level. Its philosophy is based on a faith in the capabilities of both teachers and students or, more generally, that all children or each student can learn.

L@S aims to build an environment that cultivates teachers' initiative and innovation so that their classrooms become areas where students can take responsibility for their own learning. In addition to helping students build deep knowledge and learn with understanding, there is a push to develop students' metacognition and self-assessment and to prepare them for future learning, encouraging strategies such as revising work and using technology to see things in different ways.

A selected cohort of teachers, called "learning center teachers," serve as an example of this vision. Their classes are observed in real-time by other teachers and school

leaders who visit either in person or by videoconferencing. Each visit aims to answer guiding questions that are codeveloped by the learning center and visiting teachers. Although observations are often initiated to address uses of technology—how to use interactive white boards, for example—learning center teachers work to refocus classroom visits toward more pedagogical issues. As one explained, "The focus is on a 'balanced' literacy: technology and instruction meshing together without one overpowering the other."

Learning center teachers are carefully selected professionals who have demonstrated their ability to reflect on practice and articulate the purposes of their instruction. The rigorous screening process considers the adequacy of their content knowledge and pedagogical capabilities as well as the willingness of the teacher and his or her school leader to commit resources to the program. Two formal opportunities for learning center teachers to come together to learn with each other and with curriculum consultants take place each year. There is additional support for those new to the program through a mentoring program with experienced L@S teachers as well as with area Computer Resource Teachers. Additionally, they are able to spend their professional development days with fellow learning center teachers to discuss issues and share artifacts and practices from the classroom. They receive technology and other resources provided by the Board, their school leaders, and the L@S program, as well as access to external expertise, research articles, and other information on cutting-edge pedagogy that is not typically available to teachers. The Board also provides release time for both the learning center teachers (2.5 days per term) and visiting teachers, which are occasionally supplemented or matched by the schools.

Inside a Literacy@School classroom, third-graders enter the classroom in the morning, put away their things, chat briefly with classmates, and get out their work without any instruction from the teacher. One student pulls out a container with wooden letter blocks and works on spelling. Another fashions wires into letters, while a third writes words with his finger in a container of sand. Students continue to work independently during the rest of their "exploration" time. They also determine their own schedule for the morning, selecting from a set of activities that are available during "station" time.

Next, the teacher projects reading materials on an interactive white board. The class reads aloud, with the teacher stopping them at various points to call out key words, encourage peer discussions, and make connections to past and future lessons as well as the real world. She uses a range of software tools to focus students' attention and bring up other relevant resources, such as PowerPoint, Microsoft Word, and Internet Explorer.

Finally, the teacher gathers a small group of students for guided reading, while the rest of the class works independently or in pairs at the stations distributed around the classroom. These include a listening station, two computers where students work on projects, and a place for individual worksheet-based activities. All activities are based on the Ontario Curriculum Expectations.

Building a Professional Learning Community

L@S collaboration – formal and informal - occurs at three levels: among all learning center teachers, between the learning center teacher and visiting teachers, and between learning center teachers and other teachers at their schools. The cornerstone of L@S is its collegial cohort of learning center teachers. There is mutual respect and trust among the participants, although the intensity of participation may vary. Learning center teachers describe the community as a network of like-minded peers who value innovation, exploration, continuous learning, and improvement. "You have to be willing to study, keep on studying, and keep on exploring, whether it be about technology or literacy… We need to keep on evolving because we ask our students to evolve all the time," said one teacher. Learning center teachers come together four to five times per year for L@S professional development days, which serve as their opportunity for in-person reflection and discussion. They also use Microsoft SharePoint for asynchronous communication. Their discussions, both face-to-face and virtual, enable them to "sharpen the saw (focused instruction)" as they become better not only at spotting good practice but also at constantly improving their own.

Collaboration between learning center teachers and the visiting teachers or others in their school is more ad hoc. Visiting teachers usually initiate classroom visits on a voluntary basis, although there are occasions where school leaders direct them to participate. School leaders are also encouraged to participate in these visits. Every observation is preceded by a short kickoff meeting to ensure alignment of purpose and understanding and followed by a more extensive debriefing for visitors to reflect on their observations. The entire visit is conducted using procedures that L@S program directors developed to help make the visit comfortable for both observers and learning center teachers and to ensure that the focus is on learning, not critique. After the observation, both learning center and visiting teachers debrief on the experience and identify possible changes that they could implement themselves. In some cases, communication between the visitors and learning center teachers evolves into longer term relationships that promote follow-through on these commitments.

"L@S is an opportunity for learning. It's about teachers teaching each other - sharing rather than criticizing and judging."

"It's a platform for discussion. We bring artifacts [to L@S PD days] and go over them carefully and articulate what's going on in the classroom in order to foster an understanding of the purpose and context in which change can occur."

"In this profession, time is so very much abbreviated and incrementalized that we don't get this opportunity…You can only develop by conversing and exchanging ideas, developing from that, and going deeper, possibly even going into your classroom to develop it further."

Empowerment and Shared Responsibility

One of the keys to L@S's success, according to teachers and program leaders, is its focus on teacher empowerment. Although in its first year, program leaders selected the content for professional development day discussions, leadership has now been turned over to teachers. They suggest and select topics they want to discuss and lead discussions themselves, with program leaders now acting more as facilitators than leaders. Teachers emphasized that their autonomy within the program extends to the classroom:

> L@S is more work as a teacher. But to someone who wants to be innovative, it gives you more freedom. I truly feel like I am a professional because I can make autonomous choices, partly because I'm part of the L@S network where innovation is encouraged, which is not always the case in regular school settings.

"Start small. Start with the people that you know will likely do the work. Then this core team will do the work voluntarily," said one former learning center teacher.

Before joining L@S, there is an expectation that a teacher has an adequate level of content knowledge and pedagogical skill, that his or her philosophy is aligned with the program's, and that he or she is not only capable of reflecting on her professional understanding and instructional choices, but also of articulating this to others. "You don't become a demonstration [learning center] teacher; you are one," said one teacher.

Learning center teachers serve as a model of good teaching that happens not in a laboratory, but in the real world. "We don't think of ourselves as gatekeepers of best practice," explained a learning center teacher. "It is not about an exemplary lesson but rather a safe place to observe, pick up new ideas and see kids learn in a new way... I need professional support for myself, and this is where I come... I can take what I can from our L@S professional development sessions and share it within my school."

Alignment at All Levels

L@S program leaders work to establish coherence and alignment with learning center teachers and their school leaders. Program leaders communicate with school leaders before selecting learning center teachers to ensure that schools will be supportive of the program and confirm that school leaders are ready to commit the school's resources, allow teachers time to participate, and accept the risks that come with instructional innovation.

Alignment must happen not only at the school level, but also at the level of the Board. L@S program directors stressed the need for "tying in to the Board's blueprint for change" as key to sustaining and growing Literacy@School. The Board makes a conscious effort to build a common understanding and use consistent language across the system, with school leaders modeling good practices such as distributed leadership that teachers can mirror in their own classrooms and in their dealings with students. Furthermore, there is an increasing emphasis on internal partnerships and cross-functional collaboration. "No silos – we work together, hav[e] a consistent message and understanding and then change things structurally to support it," explained the L@S program leaders.

Teachers reported that student engagement and enthusiasm for learning have risen sharply. According to one mathematics teacher, "[students] are eager to learn more. Students will prepare their lesson and study the next chapter even though I do not ask them to do the preparation work. They do it by themselves."

Challenges and Opportunities

L@S as a program has matured at least in part because of program leaders' willingness to learn from mistakes, large and small. Their initial focus was on model schools and idealized learning environments. This focus created tensions from the elementary teachers' union and was sometimes seen as too different to be applicable. The current L@S model is a response to those conflicts and is accepted by teachers, schools, and the teachers union alike.

The program continues to struggle to address some educators' perception that learning center teachers are "the favored ones." A few learning center teachers reported that their colleagues outside the program seemed to resent their increased access to technology. But for others the technology initially intended for the learning center teacher became a shared resource for the school. Some visiting teachers have been judgmental, intrusive, and even disruptive during the lesson. The program thus spent time developing protocols that structured classroom visits so that each one is purposeful, targeted, and focused on understanding classroom practice and the kinds of environments that help this thrive rather than on critiquing the learning center teacher. They have found that communication is the key to success and now work together with school leaders, teachers, and the Board to codevelop action plans for the future.

In Literacy@School's current model, visiting teachers get a "snapshot" of what is happening in the classroom. Their goal now is to become a 'living lab' that will allow periodic observations and teacher interactions over a period of time, coupled with ongoing conversations within the school building and across the Board. L@S leaders believe "There is tremendous expertise that needs to be linked in formative ways… By modeling the change in the system, it becomes easier to change the system."

5. Summary and Recommendations

5.1 Results Summary

This report has described the progress of schools in 11 countries that have taken on the challenge of comprehensive educational innovation. The schools were in different stages of development when they entered Microsoft's Innovative Schools Program 2 years ago and are pursuing paths of reform appropriate to vastly different local contexts of education. As a result, conclusions about their progress as a set must be drawn with caution. Nevertheless, their experiences demonstrate a number of common themes that have implications for other school change efforts.

During the program's first 2 years, most of the pilot Innovative Schools took positive steps to developing and communicating a vision for change, establishing a more collaborative culture among teachers, and providing supports for teachers to start building the skills needed for student-centered instruction. As emphasized in the Innovation Framework (Microsoft Corporation, 2009), establishing a school-wide culture supportive of innovation and supporting teachers' professional development as they begin to experiment with new models of teaching and learning are important foundational tasks toward the ultimate goal of transformed teaching and learning.

By the end of 2 years of reform, many of the schools had made progress in refining and focusing their visions. For many, it took time to craft a vision for change that was informed by global models of 21st century teaching and learning yet was sufficiently grounded in local needs to be appropriate in context and sufficiently specific to suggest concrete actions for teachers. It also took time to move past the excitement of the introduction of technology to focus on learning and how technology can support it. After 2 years, at many schools this shift was beginning to be seen in the discourse around reform and the processes that support it.

The professional development programs that were described as most useful were ongoing processes rather than one-time trainings, combined formal and informal elements, and provided opportunities to reflect on the learning opportunities afforded by new tools rather than solely training on how to use the tools themselves. The most active teacher professional communities within the pilot schools were motivated by specific and practical tasks such as developing curriculum together or researching the outcomes of new classroom practices. The schools that made the most progress took thoughtful steps to promote innovation and readiness among teachers through the deliberate design of supports such as these.

In the classroom, on average across the schools, student use of technology increased from Year 1 to Year 2, as did the sophistication of learning applications for technology. A larger proportion of observed lessons involved students' use of technology in the second year than in the first. Moreover, researchers saw a significant increase in the proportion of student uses of technology that included higher level applications such as designing a multimedia product or collaborating online, as opposed to more basic uses such as word processing and seeking predefined information on the Internet. This suggests that where teachers had begun to give assignments that ask students to use technology, some were doing so in increasingly sophisticated ways. High-level uses of technology tended to be associated with increases in 21st century learning opportunities more generally, so an increase in these types of technology uses may be a harbinger of future progress toward innovative teaching and learning.

Between the first and second years of reform, pilot schools made less progress on average in implementing new models of teaching and learning in the classroom. Although the data indicate pockets of innovation in many schools and more frequent teacher talk about new methods in most schools, the majority of instruction documented in this research retained a largely traditional flavor. Overall, some schools made progress on some measures of innovative instruction and others lost ground, but there was no significant change across the set of schools in most aspects of pedagogy from Year 1 to Year 2. This result is not surprising given that many of these schools needed the first 2 years to develop the vision and culture for innovation that might support future changes to practice. Prior research suggests that whole-school instructional reform generally requires more than 2 years to take root across classrooms (Borman, 2005; Kahne, Sporte, & de la Torre, 2006; Shear et al., 2008) and that it is common for new practices to be adopted gradually, with some teachers using them before they are implemented widely throughout the school (Law & Chow, 2008). The experience of many of these schools seems consistent with these patterns.

Within data collected from classrooms in this research, students' work exhibited stronger 21st century skills in response to assignments that called for those skills. Where teachers had made progress in structuring assignments to promote the development and use of skills like knowledge construction, collaboration, and problem-solving, student work (on average) demonstrated a higher degree of those skills. As found in prior research (e.g., Newmann, Lopez, & Bryk, 1998), the quality and character of the assignments that students are asked to work on are strong factors that shape students' skill development and performance.

As a set, these schools offer a number of strong examples of innovative practices, either at the school level or within teaching and learning. Although innovative practices have yet to permeate teaching and learning widely overall across these schools, many of the schools have made important progress in different areas of the Innovation Framework. Chapter 4 presents examples of schools that demonstrate strong student-centered learning practices, successful programs of teacher-centered professional development, or thriving and productive professional learning communities. These examples can serve as useful models for other schools that are taking on the challenge of whole-school reform.

5.2 Recommendations for Schools and Reform Programs

The early experience of the pilot Innovative Schools suggests a number of recommendations for educators who seek to promote innovative technology-supported teaching and learning throughout their schools and for programs that seek to catalyze similar changes across multiple school contexts.

Recommendations for School-Based Reforms

- Stay focused on teaching and learning. In many environments the use of technology is in itself exciting and innovative and may be a primary driver of reform. However, if the ultimate goal is to provide students with a well-rounded set of opportunities for innovative learning, keeping teaching and learning at the forefront is essential. The most successful schools in this pilot program had clear visions for outcomes for learners and school cultures and professional supports were aligned with reaching this vision.
- Take the time to get the foundation right. Some of the schools that began to introduce technology without a clear plan and supportive culture found it necessary to give these important elements more attention in the second year of reform. A strong organizational culture and supportive infrastructure are essential foundations for the journey of innovation.
- Find explicit ways to catalyze change. Comprehensive changes to teaching and learning can be daunting, and some teachers will volunteer to take them on more readily than others. Among the pilot schools, new capacities such as a physical space designed to be flexible and new activities such as an explicit curriculum development project served as catalysts for change and encouraged innovative thinking among teachers.
- Help teachers experience early successes or witness the early successes of their peers. In most schools, new teaching practices began as smaller experiments and took hold on a broader scale once teachers began to see their power, as one teacher put it, "on the faces of the children." Establishing early opportunities to put new ideas into practice can be the basis for professional learning community discussions about what works and how practices can be improved.
- Leverage opportunities for innovation within a traditional system. Some of the pilot schools had the benefit of flexible education systems with policies that support innovation, but others operated within much more restrictive educational environments. Such schools had to be creative in finding opportunities for innovation by focusing on a part of the instructional program that had more flexibility than others or adding a new course that would not be subject to the same restrictions. In most cases, while traditional educational systems were a persistent challenge to innovation, educators still found ways to make a difference.

Recommendations for Reform Programs

- Recognize that change takes time. As this report and prior research have stressed repeatedly, 2 years is a very short time for making comprehensive changes to teaching and learning. Funders and stakeholders often hope to see progress quickly, and many reforms have been judged unsuccessful when test scores have remained unchanged after just a short time. The experience of these pilot schools suggests that reform is a process, and substantial progress must be made on school-level cultures and supports for reform before widespread change can be expected in the classroom. Reform program supports must be sustained until school-based innovations are stable enough to have a life of their own.

- Offer early supports for translating ideas into practice. During the period of this pilot program, many of the schools struggled to move from a broad vision to a practical focus for school-based reform and to come to consensus on what big ideas like "project-based learning" and "technology-supported teaching and learning" should look like in practice. Practical tools like the rubrics for analyzing assignments and student work described in this report and well-documented examples of successful practices can help to make such ideas concrete enough to test in the classroom and can help build a common vocabulary among teachers who are discussing reform.

- Foster cross-school communities of practice that have the same characteristics as effective within-school communities of practice. This report suggests that teachers in school-based learning communities need a specific and practical focus for their collaboration and time to reflect together on progress. In the same way, such features as opportunities for joint classroom projects or collaborative research activities can add power to communities of schools that come together to make a difference.

5.3 Next Steps

After just 2 years, it is difficult to predict the sustainability of the pilot schools' reform programs. But for schools that have experienced some early success, educators believe that 2 years is just the beginning. Many of the schools began their reforms with a subset of teachers—either in particular grades or subject areas or with early adopters who volunteered to pilot reforms. Where initial reforms have been successful, the schools have plans to continue rolling out new ideas and practices to additional teachers, subjects, and grades. As described in this report, many of the reforms are simultaneously evolving in other ways and some are continuing on a path to focus more on learning opportunities and less exclusively on technology.

In addition, some of the schools are engaged in local programs to scale their innovations beyond the school walls. For example, the school district in which the UK Innovative School operates is undergoing a comprehensive reform as part of the nation's Building Schools of the Future program and plans to use the school as a model for instruction. Several schools are engaged in a learning community within their local area in which practices are tested and shared, an effective strategy for sustaining and scaling innovation.

After the 2 years of this pilot program, the Innovative Schools Program is likewise continuing to grow and develop. In 2009 an expanded program was initiated, with 12 mentor schools (among them some of the pilot schools) and 30 "pathfinder" schools working together in multicountry partnerships to encourage cross-pollination of ideas across countries and contexts. Like the original pilot schools, some of the pathfinders are established innovators and others are new to reform, but all are committed to taking the next steps to building a student-centered learning environment that will better prepare today's students for tomorrow's opportunities and challenges.

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Technical Appendix: Methodology

This appendix explains the methodology for collecting and analyzing data from each of four data sources that contributed to this research. Those four sources of data were:

- Classroom observations
- Teacher assignments and student work
- Qualitative data, including interviews with school leaders and teachers, and focus groups with students (conducted by the country evaluators)
- Case studies at five pilot schools, including interviews with school leaders, teachers, and other stakeholders; focus groups with students; and classroom observations (conducted by SRI).

In addition, extant achievement data and other locally relevant measures of student outcomes were collected in each country. These sources were analyzed locally as appropriate; because the measures necessarily varied widely across countries, no global analysis was conducted.

Classroom Observations

Evaluators for each of the pilot schools conducted observations to obtain direct evidence about the environment and practices in classrooms. Evaluators used the same classroom observation protocol that was used in Year 1, with a few minor adjustments for clarity. The constructs in the classroom observation protocol are based on ideas about 21st century teaching and learning from the Innovation Framework, taxonomies of 21st century skills (e.g., Partnership for 21st Century Skills, 2007; UNESCO, 2008; Government of South Australia, 2008) and research on how people learn (Bransford, Brown, & Cocking, 1999). The protocol enabled observers to capture information about the classroom environment, technology available and used in the classroom, and teacher and student roles and actions.

The global evaluation design specified that researchers from each country observe 8 lessons: 3 in humanities, 3 in science, and 2 other lessons selected to represent the school's best innovation efforts. Because local circumstances for the research varied,

researchers observed anywhere from 2 to 10 lessons across the 11 countries. Overall, the complete data set includes 72 lessons taught by 69 different teachers. Table A shows the sample of classroom observations.

Table A. Classroom Observation Sample

	Year 1	Year 2
Countries	10	11
Teachers	65	69
Lessons	73	72

The analysis presented in this report is based on teacher-level data. In most cases, the evaluators observed each teacher only once; however, in some countries evaluators observed the same teacher across multiple lessons. In those cases, SRI randomly selected one lesson to include in the dataset for each teacher to avoid overrepresentation of a few individual teachers in the sample.[29] Thus, the analysis for this report uses data from 69 of the 72 observed lessons (one lesson per teacher).

Nearly half the observed lessons were in the humanities (49%), with about a quarter in science/math (26%) and about a quarter in other subject areas (24%). The lessons categorized as other included such courses as art, music, gymnastics, home economics, health, and nutrition. The majority of the observed lessons were on grade-level or mixed-ability lessons (78%), with only a few lessons that were advanced or remedial. The majority (58%) of the lessons took place in regular classrooms, and fewer occurred in computer labs (12%) and other facilities (30%), including flexible learning spaces, the cafeteria or gymnasium, science laboratories, or other specialized classrooms.

Analysis of classroom observation data took into account local circumstances as appropriate. For example, there were no classroom observations in Finland in Year 1 because the pilot school was still in early planning stages at that time. In Year 2, the school was still not yet open, but evaluators observed classes of local teachers who had already been recruited to teach in the new school or otherwise fit the criteria for the school's teachers. Classroom observation data from Finland are included in the Year 2 analysis, but they are not included in any of the analysis comparing Year 1 with Year 2. In addition, the number of observations in each country varied from year to year. As a result, we weighted countries within years to ensure that they contributed to the sample equally and to ensure that estimated changes were related to classroom practice rather than noise created by disproportionate country representation.

29 For the Year 1 classroom observation data analysis, SRI used a different method for combining data from multiple observed lessons for the same teacher. SRI chose not to combine data in this manner again because of complications that arose in reconciling data across the lessons in this year's data. For the analysis of change over time, SRI returned to the Year 1 data and randomly selected one lesson for each teacher that was observed more than once, so that the data from both years would be comparable.

The Innovative Teaching Index was created to provide a measure of the overall strength of innovative teaching and learning at the pilot schools. The Index includes 13 different innovative practices that research suggests are characteristic of effective innovative instruction.[30] On the basis of an initial set of candidate variables, SRI used factor analysis to suggest which items captured the construct of innovative teaching most reliably.[31] Lessons received 1 point for each item in the index that was observed during the lesson; the final Index score was derived by summing across the 13 items. Thus, for any given lesson, the maximum score on the Innovative Teaching Index was 13 and the minimum was 0.

Teacher Assignments and Student Work

Another type of data included in these analyses came from collection of teacher assignments and student work. Teacher assignments are the activities teachers ask students to do. They can include homework or class work, long-term or 1-day assignments, basic worksheets, or complicated projects. Pieces of student work are students' responses to teacher assignments, which might include essays, worksheets, presentations, or other types of work. By coding samples of teaching assignments and student work on common rubrics, we can see the extent to which students have the opportunity to acquire 21st century skills and the extent to which they are demonstrating those skills. SRI developed this set of rubrics for innovative teaching and learning, drawing on input from the pilot schools (provided during a November 2007 meeting in Oulu, Finland) as well as on prior research (Bryk, Nagaoka, & Newmann, 2000; Matsumura & Pascal, 2003; Mitchell et al., 2005).

In each of the Innovative Schools, evaluators were asked to collect teacher assignments and student work from two broad subject areas (humanities and science) and from one of two age levels (10-year-olds or 15-year-olds). In each school, six teachers were asked to submit assignments and work at four points during the evaluation. We divided these four collections into Year 1 and Year 2 based on school years (2007–08 and 2008–09).[32] Year 1 includes two time points: October–December 2007 and February–May 2008. Year 2 also includes two time points: October–December 2008 and February–May 2009. At each data collection time point, teachers submitted three assignments, along with 10 pieces of student work for one of those three assignments. Thus, over the course of the evaluation, each teacher would have submitted a total of 12 assignments and 40 pieces of student work.

30 The Innovative Teaching Index is an updated version of the original Innovative Teaching Scale from Year 1, with changes made to improve the performance of the scale. Ultimately, factor analysis indicated that adding several items to the original set and dropping others would serve to better represent our construct of innovative teaching. To conduct the change-over-time analysis, SRI applied the Year 2 scale to the Year 1 data so that the Index scores were comparable.

31 Two items were removed from the index because the factor analysis revealed that they did not load well with the other items in the index. The items that were removed were (1) students get exposed to issues related to global interdependency and (2) the teacher asked predominantly high-level thinking/open-ended questions.

32 These dates represent the typical school year in the Northern Hemisphere. Most of the Innovative Schools in the pilot program operated on this schedule. Two schools, in Chile and Brazil, operate on a calendar that is closer to the calendar year. When necessary, evaluators in these two countries adapted their data collection dates.

Samples sizes and characteristics (such as the exact age of the students) varied from country to country based on the design of the reform program, the size of the school, and practical limitations of what teachers were able to submit. For example, some schools were too small to include six teachers of the target ages and subjects in their samples. Table B shows the samples of learning activities and student work used in the analysis.

Table B. TASW Sample

	Year 1	Year 2
Countries	10	11
Teachers	55	54
Teacher Assignments	272	250
Student Work Samples	899	835

SRI disseminated rubrics and detailed coding guides to the national evaluators at 2-day face-to-face training sessions. Once trained to use the rubrics, the national evaluators in turn recruited and trained coders in their countries.[33] Coding took place in the local language of instruction so in most countries the rubrics were translated into the local language. Where possible, the coders in each country were teachers of the same subject matter and age levels as the teachers who provided the assignments and student work; thus, for secondary schools science teachers would code science assignments, primary school teachers would code primary school assignments, and so on. To ensure impartiality and anonymity, evaluators were asked to recruit coders from schools other than the pilot school.[34]

The goals for coding teacher assignments and student work were twofold: to code consistently across all the countries and to code with sensitivity to local context. Coders were trained to use the rubrics consistently with the international process, while their background as teachers allowed them to take into account different expectations in each country. Coders worked on one dimension at a time, getting trained on a dimension and conducting all the relevant coding before moving on to the next dimension.

All teacher assignments and a portion of student work samples were double-coded so that agreement between coders could be calculated. In Year 2, coders evaluating the same teacher assignment agreed on a code 67% of the time and were within 1 point of each other 93% of the time. For student work, coders agreed 81% of the time and were within 1 point of each other 96% of the time. When two coders differed in their evaluation, the average of the two codes was used for analysis.

33 In one country, it was not possible to recruit teachers as coders, and all coding was carried out by the national evaluators.

34 In one country, the coding process was used as a professional development opportunity for teachers at the Innovative School.

After coding, national evaluators sent the codes to SRI for global analysis. As with the classroom observation data, we created sampling weights for each year of the study so that each country would be weighted equally within the sample and across years. This weighting is necessary when combining or analyzing data across years to account for the fact that different countries submitted different numbers of assignments and student work artifacts. We then centered the scores on each dimension for each country to eliminate country-by-country differences in the "leniency" of the scoring. To center the scores, we rescaled the scores in each country to have a mean of 0 across all dimensions and across both years. Next, we used a linear regression model to test whether the year-to-year changes in each dimension across all countries were statistically significant. We adjusted the standard errors to account for the clustered nature of the sample (i.e., teachers and students were all sampled from the same small number of schools). Similarly, when examining the correlations between assignment scores and scores on student work, country-centered scores were used in the computation.

Qualitative Data from Site Visits by National Evaluators

Between February and May 2009, national evaluators in each country conducted site visits to the pilot school. During these visits, each evaluator was asked to interview school leaders and eight teachers and to conduct three focus groups with students, with approximately six to eight students per group. In addition, evaluators interviewed the Microsoft program manager in each country and in some cases other local stakeholders as appropriate. Evaluators provided SRI with detailed country-specific qualitative reports from their visits, summarizing qualitative data and findings from interviews, student focus groups, and classroom observations in accordance with a common template developed by SRI. Those reports were a primary source of data for this global report.

To analyze qualitative data, SRI developed a coding scheme, using as a basis both the Innovation Framework and the country qualitative reports to determine codes to be included. Reports were coded by two analysts who worked together to come to agreement on coding decisions. Coders used a qualitative analysis software program called Atlas.ti, which allowed segments of text from multiple reports to be sorted according to topic and content for analysis. SRI researchers then undertook analysis of the topical reports, with one researcher as primary analyst for each major category. Primary analysts' work was reviewed in a team setting that included "country coordinators," SRI analysts who had focused on a subset of the pilot school countries over the course of the 2-year evaluation, to ensure that interpretations of coded data remained in context of the overall situation at each school.

Case Studies by SRI International

To provide a deeper look at reform in particular countries, SRI conducted case study visits to five pilot schools. These schools were selected to represent a diverse set of contexts and reform focus areas and are intended to illustrate noteworthy practices in the areas described by this report.

At each school, researchers collected qualitative data using protocols and procedures that were adapted to fit the context of each specific school. Researchers visited each school over 2 to 3 days and interviewed a variety of stakeholders, varying the sample based on the particular people most deeply involved in reform at each school. In all schools, researchers talked to the school leader, at least four teachers, and several groups of students and observed at least four classes. Researchers also talked to school technology directors, representatives from local education authorities, and teacher leaders or academic department chairs. Finally, researchers attended planning meetings and other events as appropriate to each context. Site visitors took detailed notes during all interviews and observations and recorded interviews (with consent of the interviewee) whenever possible to secure backup copies of the data. For each site, researchers reviewed their interview and observation notes and completed a case study debrief using a format based on principles derived from How People Learn (Bransford, Brown, & Cocking, 1999). These case study debriefs informed a decision about the focus of the final case study reports presented here and provided the detailed data for those reports. The case study reports were sent to the national evaluator, the school leader, and the Microsoft academic program manager in each of the respective case study countries for review and confirmation of accuracy.

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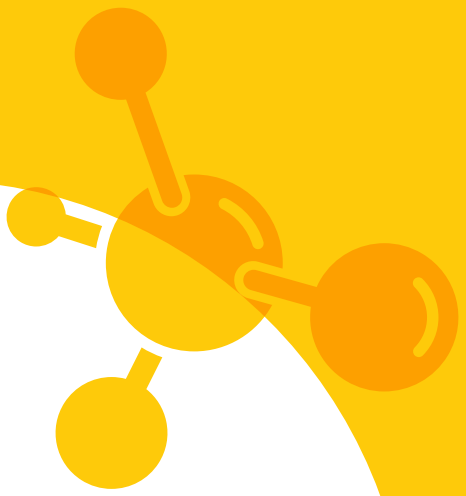

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